



Aerospace Medicine
and Biology
A Continuing
Bibliography
with Indexes

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BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH
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ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series) N88-16624 — N88-18548

IAA (A-10000 Series) A88-24827 — A88-28711

AEROSPACE MEDICINE AND BIOLOGY

**A CONTINUING BIBLIOGRAPHY
WITH INDEXES**

(Supplement 311)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in May 1988 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



Scientific and Technical Information Division 1988
National Aeronautics and Space Administration
Washington, DC

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INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 240 reports, articles and other documents announced during May 1988 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects of biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Seven indexes — subject, personal author, corporate source, foreign technology, contract, report number, and accession number — are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1988 Supplements.

Information on the availability of cited publications including addresses of organizations and NTIS price schedules is located at the back of this bibliography.

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TYPICAL REPORT CITATION AND ABSTRACT

NASA SPONSORED
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ACCESSION NUMBER	→	N88-10483*	Texas Univ., Houston. Health Science Center.	←	CORPORATE SOURCE
TITLE	→	PREVENTION OF DISUSE OSTEOPOROSIS: EFFECT OF SODIUM FLUORIDE DURING FIVE WEEKS OF BED REST Final Report			
AUTHOR	→	VICTOR S. SCHNEIDER	Oct. 1987	64 p	PUBLICATION DATE
		(Contract NAS9-16688)			AVAILABILITY SOURCE
REPORT NUMBERS	→	(NASA-CR-172018; NAS 1.26:172018)	Avail: NTIS HC A04/MF		PRICE CODE
		A01 CSCL 06E			
COSATI CODE	→	An attempt was made to modify factors which promote disuse osteoporosis and thereby prevent it from occurring. Since fluoride is currently used to enhance bone formation in the treatment of low turnover osteoporosis, it was hypothesized that if the fluoride ion was available over a long period of time that it would slow the demonstrated loss of calcium by inhibiting bone resorption and enhancing bone formation. This study was used to determine whether oral medication with sodium F will modify or prevent 5 weeks of bed rest induced disuse osteoporosis, to determine the longitudinal effects of 5 weeks of bed rest on PTH, CT and calcitriol, to measure muscle volume changes and metabolic activity by magnetic resonance imaging and magnetic resonance spectroscopy during prolonged bed rest, to measure changes in peak muscle strength and fatigability, and to measure bone turnover in bone biopsies. Subjects were studied during 1 week of equilibration, 4 weeks of control ambulation, 5 weeks of bed rest, and 1 week of reambulation.			

E.R.

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED
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ACCESSION NUMBER	→	A88-12321*	National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.	
TITLE	→	CONTINUOUS MONITORING OF BLOOD VOLUME CHANGES IN HUMANS		
AUTHORS	→	H. HINGHOFFER-SZALKAY and J. E. GREENLEAF (NASA, Ames Research Center, Moffett Field, CA; Graz, Universitaet, Austria)	←	AUTHOR'S AFFILIATION
JOURNAL TITLE	→	Journal of Applied Physiology (ISSN 0161-7567), vol. 63, Sept. 1987, p. 1003-1007. Research supported by the Oesterreichische Akademie der Wissenschaften. refs (Contract NASA TASK 199-21-12-07)		
		Use of on-line high-precision mass densitometry for the continuous monitoring of blood volume changes in humans was demonstrated by recording short-term blood volume alterations produced by changes in body position. The mass density of antecubital venous blood was measured continuously for 80 min per session with 0.1 g/l precision at a flow rate of 1.5 ml/min. Additional discrete plasma density and hematocrit measurements gave linear relations between all possible combinations of blood density, plasma density, and hematocrit. Transient filtration phenomena were revealed that are not amenable to discontinuous measurements.		

I.S.

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 311)

JUNE 1988

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LIFE SCIENCES (GENERAL)

A88-25050

MAGNETOTACTIC BACTERIA AND THEIR MAGNETOFOSSILS IN SEDIMENTS

H. VALI, O. FOERSTER, G. AMARANTIDIS (Muenchen, Technische Universitaet, Munich, Federal Republic of Germany), and N. PETERSEN (Muenchen, Universitaet, Munich, Federal Republic of Germany) *Earth and Planetary Science Letters* (ISSN 0012-821X), vol. 86, no. 2-4, Dec. 1987, p. 389-400. DFG-supported research. refs

A88-25256

ROLE OF BAROMETRIC PRESSURE IN PULMONARY FLUID BALANCE AND OXYGEN TRANSPORT

BENJAMIN D. LEVINE, KEISHI KUBO, TOSHIO KOBAYASHI, MASAO FUKUSHIMA, TOSHISHIGE SHIBAMOTO (Shinshu University, Matsumoto, Japan) et al. *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, Jan. 1988, p. 419-428. refs

Five unanesthetized chronically instrumented sheep with lung fistulas were placed in a decompression chamber and exposed to hypobaric hypoxia, normobaric hypoxia, and normoxic hypobaria in an attempt to assess the role of barometric pressure in high-altitude pulmonary edema. A combination of slow decompression and/or simultaneous adjustment of inspired P(O₂) offered three successive stages of simulated altitudes of 2,600, 4,600, and 6,600 m during which hemodynamics and lymph flow were monitored. Under both hypoxic conditions, significant and equivalent elevations in pulmonary arterial pressure (Ppa), cardiac output, and heart rate were observed. Normoxic hypobaria was also accompanied by a smaller but significant rise in Ppa. Arterial hypoxemia was observed under all three conditions. K.K.

A88-25527

ALTERATIONS IN THE ENDOCRINE SYSTEM OF DOGS WITH THE HEMATOPOIETIC FORM OF RADIATION SICKNESS [IZMENENIYA V ENDOKRINNOI SISTEME SOBAK PRI KROVETVORNOI FORME LUCHEVOI BOLEZNI]

A. O. KOROTKEVICH (Institut Biologicheskoi Fiziki, Moscow, USSR) *Radiobiologiya* (ISSN 0033-8192), vol. 27, Nov.-Dec. 1987, p. 765-770. In Russian. refs

Alterations in the activity of the adrenal cortex, pancreas, and thyroid gland systems during the onset and the consecutive stages of hematopoietic radiation sickness were studied in dogs irradiated with Cs-137 (3.18 and 3.57 Gy). Serum contents of cortisol, insulin, and triiodothyronine were monitored using radioimmunoassay methods, and the index of the endocrine status was calculated by the method of Zaprudnova et al. (1984). It was found that the most pronounced changes occurred during the primary response to irradiation and at the height of radiation sickness, with the respective levels returning to normal 24 hrs after irradiation. There was a decrease of cortisol and an increase of insulin at 3 and 8 hrs postradiation, with changes being more pronounced in dogs that survived the effects of irradiation. The level of triiodothyronine

decreased to about 40 percent, and that of insulin increased to 250 percent of normal in all dogs 12-14 days postradiation. Dogs that did not survive the experiment, exhibited, in addition, large increases in cortisol. I.S.

A88-25528

ACTIVATION OF THE ARACHIDONIC ACID METABOLISM AS A PROTECTIVE RESPONSE OF AN ORGANISM TO IRRADIATION AND IRRADIATION COMBINED WITH THERMAL TRAUMA [AKTIVATSIIA METABOLIZMA ARAKHIDONOVY KISLOTY - ZASHCHITNAIA REAKTSIIA ORGANIZMA PRI OBLUCHENII I KOMBINIROVANNOM RADIATSIONNO-TERMICHESKOM PORAZHENII]

A. G. PANOSIAN, K. O. DZHINANIAN, K. V. GEVONDIAN, M. N. LEBEDEVA, G. S. VARTANIAN (AN ASSR, Institut Tonkoi Organicheskoi Khimii, Yerevan, Armenian SSR) et al. *Radiobiologiya* (ISSN 0033-8192), vol. 27, Nov.-Dec. 1987, p. 770-776. In Russian. refs

A88-25529

BIOLOGICAL EFFECT OF 9 GEV PROTONS AND THE RADIOPROTECTIVE EFFECTS OF ATP AND AMP ON THE CORNEAL EPITHELIUM CELLS OF MICE [BIOLOGICHESKOE DEISTVIE PROTONOV 9 GEV I RADIOZASHCHITNOE VLIYANIE ATF I AMF NA KLETKI EPITELIIA ROGOVITSY MYSHEI]

S. V. VOROZHTSOVA, B. S. FEDORENKO, V. N. ANDRUSHCHENKO, and P. N. IASHKIN (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) *Radiobiologiya* (ISSN 0033-8192), vol. 27, Nov.-Dec. 1987, p. 779-783. In Russian. refs

The cytogenic and cytological effects of cosmic rays on corneal epithelium and the radioprotective efficiency of adenine nucleotides were investigated in mice irradiated with 9-GeV protons or gamma rays, with some of the animals in both groups injected with 350 mg/kg ATP or AMP. Both types of radiation were found to cause sharp decreases in the epithelial regeneration rate and in the numbers of aberrant mitoses, with the aberrations increasing with radiation dose; the effects were maximal at 24 hrs postradiation. Proton rays were found to be more damaging than the gamma rays. Both ATP and AMP exhibited radioprotective effects, decreasing the numbers of aberrant mitoses to the same degree. The results are pertinent to the study of radiation effects on astronauts during long-duration space flights. I.S.

A88-25530

POSTRADIATION CHANGES IN THE SYSTEMS OF ACTIVE ION TRANSPORT IN THE CNS - THE MITOCHONDRIAL ATPASE [POSTRADIATSIONNYE IZMENENIYA V SISTEMAKH AKTIVNOGO TRANSPORTA IONOV V TSNS. ATFAZA MITOKHONDRII]

A. I. DVORETSKII and I. V. GERASIMENKO (Dnepropetrovskii Gosudarstvennyi Universitet, Dnepropetrovsk, Ukrainian SSR) *Radiobiologiya* (ISSN 0033-8192), vol. 27, Nov.-Dec. 1987, p. 825-828. In Russian. refs

A88-25531

METHYLATION AND CARBOXYMETHYLATION OF RAT BRAIN CALMODULIN AT AN EARLY STAGE OF ACUTE RADIATION DAMAGE [METILIROVANIE I KARBOKSIMETILIROVANIE KAL'MODULINA GOLOVNOGO MOZGA KRYSA NA RANNEM ETAPE OSTROGO LUCHEVOGO PORAZHENIIA]

T. I. PARKHOMETS, A. N. VASIL'EV, and N. E. KUCHERENKO (Kievskii Gosudarstvennyi Universitet, Kiev, Ukrainian SSR) Radiobiologiya (ISSN 0033-8192), vol. 27, Nov.-Dec. 1987, p. 831-834. In Russian. refs

A88-25532

RADIOPROTECTIVE EFFICIENCY OF ACYL HYDRAZONES [RADIOZASHCHITNAIA EFEKTIVOST' ATSLIGIDRAZONOV]
O. V. ARAPOV, O. F. ALFEROVA, E. I. LEVOCHESKAIA, and I. I. KRASIL'NIKOV (Voenno-Meditsinskaia Akademiia, Leningrad, USSR) Radiobiologiya (ISSN 0033-8192), vol. 27, Nov.-Dec. 1987, p. 843-846. In Russian. refs

The radioprotective efficiency of acyl hydrazones of the general formula $R(1)CONH=CHR(2)$ was investigated in rats and mice irradiated with Co-60 (7.5 Gy at the rate of 2 Gy/min) and inoculated with suspensions of acyl hydrazones based on various derivatives of salicylic and beta-oxynaphthoic aldehydes. The radioprotective efficiency of the acyl hydrazones was found to vary from 0 to 60 percent, in terms of increased survival. The radioprotective activity of hydrazones was found to be related to their ability to complex transition metals. I.S.

A88-26006

RESPONSE OF APICAL DENDRITES OF PYRAMIDAL NEURONS OF THE BRAIN CORTEX TO EXPERIMENTAL ISCHEMIA [REAKTSIIA APIKAL'NYKH DENDRITOV PIRAMIDNYKH NEIRONOV KORY MOZGA NA EKSPERIMENTAL'NUIU ISHEMIU]

N. S. KOSITSYN, E. G. IONKINA, and V. M. SERDIUCHENKO (AN SSSR, Institut Vysshei Nervnoi Deiatel'nosti i Neurofiziologii, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 298, no. 1, 1988, p. 247-250. In Russian. refs

Experimental results are presented on the structure and functional condition of the cerebral brain cortex at the early stages of experimental ischemia produced in cats through the compression of the main arteries feeding the brain. Particular emphasis was placed on the structure and function of the apical dendrites, which, passing through the cortex toward its surface, receive the the major part of the afferents. Results indicate that hypoxia should be viewed as a factor mobilizing the reserve capabilities of the brain under extreme conditions and in the case of certain pathological states. B.J.

A88-26070

CELLULAR MAKE-UP OF THE MOUSE SPERMATOGENIC EPITHELIUM DURING AND AFTER EXPOSURES TO CONSTANT MAGNETIC FIELDS OF VARIOUS DURATION [KLETOCHNYI SOSTAV SPERMATOGENNOGO EPITELIIA MYSHEI VO VREMIA I POSLE VOZDEISTVIIA POSTOIANNYKH MAGNITNYKH POLEI RAZNOI DLITEL'NOSTI]

A. D. STRZHZHOVSKII and V. M. MASTRIUKOVA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) Akademiia Nauk SSSR, Izvestiia, Seria Biologicheskaiia (ISSN 0002-3329), Jan.-Feb. 1988, p. 91-97. In Russian. refs

A88-26072

BIOGEOCHEMICAL ASPECTS OF THE EVOLUTION OF ORGANISMS [BIOGEOKHIMICHESKIE ASPEKTY EVOLIUTSII ORGANIZMOV]

E. A. BOICHENKO (AN SSSR, Institut Geokhimii i Analiticheskoi Khimii, Moscow, USSR) Akademiia Nauk SSSR, Izvestiia, Seria Biologicheskaiia (ISSN 0002-3329), Jan.-Feb. 1988, p. 118-124. In Russian. refs

The role of living organisms in the cycling and migration of elements in the biosphere and beyond is discussed. Attention is given to the specific processes affecting the composition of the biosphere, in which various organisms, including man, participated

and continue to participate in the formation, migration, and concentration of various atmospheric and earth constituents and to the redox and biochemical processes taking place in living matter. Changes in the contents of various elements in unicellular organisms during the evolution of the biosphere are shown to be related to changes in their metabolic processes and to changes in the biogeochemical functions of these organisms. I.S.

A88-26146

THE EFFECT OF AIR IONS ON THE METABOLISM IN AN ORGANISM EXPOSED TO IONIZING RADIATION

RYSZARD BERNAT and ALINA GROCHOWALSKA (Akademia Medyczna, Poznan, Poland) Postepy Astronautyki (ISSN 0373-5982), vol. 20, no. 1-2, 1987, p. 65-75. In Polish. refs

An investigation was made of Wistar rats irradiated with a single dose of ionizing irradiation and exposed to 6 days of positive or negative air ions. The metabolism was estimated on the basis of the adenylic nucleotide concentration in the blood and tissues and the concentration of glucose and free fatty acids in the blood. It was demonstrated that the positive air ions enhanced the catabolism processes in the irradiated organism. The negative aeroions have the anabolic influence of the irradiations effects.

Author

A88-26147

EFFECTS OF AMITRIPTYLIN ON ALTITUDE HYPOXIA AND ACCELERATION TOLERANCE

WLADYSLAW SWIECICKI, ZBIGNIEW KOTER, and EWA REJMENT (Wojskowy Instytut Medycyny Lotniczej, Warsaw, Poland) Postepy Astronautyki (ISSN 0373-5982), vol. 20, no. 1-2, 1987, p. 77-90. In Polish. refs

The effect of amitriptylin on tolerance to altitude hypoxia and accelerations was examined. The experiments were carried out in rats whose deep body temperatures, catecholamines, and corticosterone levels were measured under the effects of the drug and stressing factors. It was found that administration of amitriptyline did not change acceleration tolerance but decreased altitude hypoxia tolerance in the rats. Author

A88-26474* Texas Univ., Houston.

QUALITY CONTROL OF MURINE MONOCLONAL ANTIBODIES USING ISOELECTRIC FOCUSING AFFINITY IMMUNOBLOT ANALYSIS

ROBERT G. HAMILTON, L. SCOTT RODKEY (Texas, University, Houston), and CHARLES B. REIMER (PHS, Div. of Host Factors, Atlanta, GA) Hybridoma (ISSN 0272-457X), vol. 6, no. 2, 1987, p. 205-217. Research supported by the Arthritis Foundation and Lupus Foundation of America. refs
(Contract NIH-AI-20590; NAS9-17403)

The quality control of murine hybridoma secretory products has been performed using two approaches for isoelectric focusing affinity immunoblot analysis: (1) a method in which antigen-coated nitrocellulose is placed on top of an acrylamide gel containing isoelectrically focused ascites to bind the antigen specific monoclonal antibody; and (2) a method in which focused ascite proteins were passively blotted onto nitrocellulose and specific monoclonal antibodies were detected with enzyme-conjugated antigen. Analysis by both methods of batches of ascites containing antihuman IgG antibodies that were produced by six hybridomas permitted effective monitoring of immunoreactive antibodies for pl microheterogeneity. R.R.

A88-26475* Auburn Univ., Ala.

ROLE OF 5-HYDROXYTRYPTAMINE IN THE REGULATION OF BRAIN NEUROPEPTIDES IN NORMAL AND DIABETIC RAT

MALAK G. KOLTA, BYRON B. WILLIAMS (Auburn University, AL), and KARAM F. A. SOLIMAN (Florida Agricultural and Mechanical University, Tallahassee) Hormone Research (ISSN 0301-0163), vol. 23, 1986, p. 112-121. refs
(Contract NIH-RR-0811; NSG-2183)

The effect of 5-hydroxytryptamine (5-HT) alteration on brain dopamine (DA), norepinephrine (NE), beta-endorphin (beta-E), and immunoreactive insulin was studied in Sprague-Dawley diabetic

and control rats. Diabetes was induced using alloxan (45 mg/kg), 15 days prior to sacrificing. Both control and diabetic animals were treated with either p-chlorophenylalanine (PCPA, 300 mg/kg) three days prior to sacrificing or fluoxetine (10 mg/kg) twice daily for three days. PCPA treatment significantly decreased brain content of 5-HT and 5-hydroxyindole acetic acid, while it caused significant increase and decrease in brain beta-E and insulin levels, respectively, in both normal and diabetic rat. Meanwhile, the administration of fluoxetine resulted in significant increase in brain content of 5-HT, DA, NE and insulin but significant decline of beta-E in diabetic and saline control rats. The results of this experiment indicate that 5-HT may be regulating both beta-E and insulin regardless of the availability of pancreatic insulin. Author

A88-26681

EFFECTS OF HYPERBARIC-ENVIRONMENT FACTORS ON THE CENTRAL NERVOUS SYSTEM [DEISTVIE FAKTOROV GIPERBARICHESKOI SREDY NA TSENTRAL'NUII NERVNUIU SISTEMU]

S. A. GULIAR and V. N. IL'IN (AN USSR, Institut Fiziologii, Kiev, Ukrainian SSR) *Fiziologicheskii Zhurnal(Kiev)* (ISSN 0201-8489), vol. 33, Nov.-Dec. 1987, p. 86-98. In Russian. refs

This paper discusses the physiological, biochemical, and neurological effects of exposures to elevated atmospheric pressures and the mechanisms responsible for the appearance of the high-pressure neurological syndrome (HPNS) on the basis of literature data on humans, other mammals, and lower organisms. Attention is given to the possible role of various brain structures and microstructures of the nervous systems in various neurological reactions, which begin with tremor at 1.0-2.0 MPa and proceed to muscle fibrillation, uncoordinated movements, sleepiness, cramps, dizziness, nausea, stomach spasms, and paralysis at progressively increasing pressures, terminating in death at pressure above 15-20 MPa. Special attention is given to the evidence demonstrating the role of hyperbaric pressure on synaptic impulse transfers. I.S.

A88-26720

PROPHYLACTIC CORTICOSTEROID SUPPRESSES ENDO-TOXEMIA IN HEAT-STRESSED PRIMATES

P. GATHIRAM, S. L. GAFFIN, J. G. BROCK-UTNE, and M. T. WELLS (Durban-Westville, University; Natal, University, Durban, Republic of South Africa) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, Feb. 1988, p. 142-145. Research supported by the Chambers of Mines. refs

This paper reports the effect of prophylactic treatment of female monkeys with methylprednisolone sodium succinate (MPSS) on the concentration of plasma lipopolysaccharides (LPSs) which appear in blood as a result of heat stress. It was found that, in the untreated animals, the plasma LPS concentration started to increase slowly (from an initial concentration of about 0.06 ng/ml), at a rectal temperature (Tr) of 41.5 C; above a Tr of 43 C, the LPS level rose rapidly reaching the mean level of about 0.315 ng/ml at a Tr of 44.4 C. In contrast, the plasma LPS concentration in the steroid group showed no increase during the entire heat-stress period. Moreover, the animals in the steroid group succumbed at a significantly higher Tr compared to controls (44.9 C vs 44.4 C of controls). I.S.

A88-27249

A TECHNIQUE FOR STUDYING LOCAL PHYSIOLOGICAL EFFECTS OF MILLIMETER RADIO WAVES ON BIOLOGICAL OBJECTS [METODIKA ISSLEDOVANIYA LOKAL'NYKH FIZIOLOGICHESKIKH EFFEKTOV VOZDEISTVIA MILLIMETROVYKH RADIOVOLN NA BIOOB'EKTY]

G. T. BUTKUS, G. M. CHERNIAKOV, V. O. SAMOILOV, A. S. PAUZHA, and E. V. BIGDAI *Fiziologicheskii Zhurnal SSSR* (ISSN 0015-329X), vol. 73, Dec. 1987, p. 1705-1708. In Russian.

This paper describes a technique for delivering controlled doses of radio waves to strictly localized areas of biological objects positioned under a microscope lens. Radio waves of 15 mW were delivered by means of an open waveguide or a waveguide equipped with a specially designed dielectric insertion piece, and the distribution of the resulting electromagnetic field in the microscope

slide zone was studied by means of a microprobe. The results of these measurements indicate the best position of the waveguide antenna and the microscope objective, such that the objective does not distort the electromagnetic field, while the energy flux density in the vision field can be regulated in the range of 40 to 400 micro-W/sq cm. I.S.

A88-27485* California Univ., La Jolla.

GRAVITATIONAL INDEPENDENCE OF SINGLE-BREATH WASHOUT TESTS IN RECUMBENT DOGS

SHINICHI TOMIOKA, SUSUMU KUBO, HAROLD J. B. GUY, and G. K. PRISK (California, University, La Jolla) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, Feb. 1988, p. 642-648. refs

(Contract NIH-P-01-HL-17731-11; NAS9-16037)

The effect of gravitational orientation in the mechanism of lung filling and emptying in dogs was examined by conducting simultaneously Ar-bolus and N2 single-breath washout tests (SBWTs) in 10 anesthetized dogs (prone and supine), with three of the dogs subjected to body rotation. Transpulmonary pressure was measured simultaneously, allowing identification of the lung volume above residual volume at which there was an inflection point in the pressure-volume curve. Combined resident gas and bolus SBWTs in recumbent dogs were found to be different from such tests in humans; in dogs, the regional distribution of ventilation was not primarily determined by gravity. The measurements did not make it possible to discern exact mechanisms of filling and emptying, but both processes appear to be related to lung, thorax, and mediastinum interactions and/or differences in regional mechanical properties of the lungs. I.S.

A88-27486

CAROTID BODY EXCISION SIGNIFICANTLY CHANGES VENTILATORY CONTROL IN AWAKE RATS

E. B. OLSON, JR., E. H. VIDRUK, and J. A. DEMPSEY (Wisconsin, University, Madison) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, Feb. 1988, p. 666-671. refs

(Contract NIH-HL-31430; NIH-HL-00780; NIH-HL-29043; NIH-HL-15469)

The role of carotid bodies in the ventilatory adaptations of awake rats was investigated by determining the effect of carotid body excision (CBX) on eupneic ventilation and the ventilatory responses to acute hypoxia, chronic hypoxia, and hyperoxia in unanesthetized rats. Compared to intact controls, the CBX rats showed chronic hypoventilation with respiratory acidosis for at least 75 days after surgery. Acute hyperoxia caused hyperventilation response in CBX rats, as compared to hypoventilation in intact rats. In acute hypoxemia, CBX was found to result in an attenuated increase in the ratio of minute alveolar ventilation to minute metabolic CO2 production. In addition, the CBX rats exhibited no ventilatory acclimatization between 1 hr and 24 hr of hypoxia and a decreased arterial P(CO2) values upon acute restoration of normoxia after 24 hr of hypoxia, in contrast to an increased arterial P(CO2) in controls. I.S.

A88-27680

BACTERIORHODOPSIN - A MEMBRANE PROTEIN TO CONVERT LIGHT ENERGY

D. ALTMUELLER, F. GROLIG, R. LINDHARDT, and G. WAGNER (Giessen, Universitaet, Federal Republic of Germany) IN: *Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings*. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 294-296. refs

(Contract BMFT-512-4001-01-QV-644-5)

Techniques for growing high-quality crystals of the electrogenic protein pump bacteriorhodopsin (BR), predominant in the membrane of *Halobacterium halobium*, are considered, with a view to studying the tertiary structure of BR. The design of a Spacelab D1 experiment to initiate crystal growth using the free interdiffusion technique (to ensure slow and undisturbed diffusion) is briefly

discussed. It is noted that orthorhombic BR crystals with the space group $p2(1)2(1)$ have been grown by Michel et al. (1980). R.R.

A88-27689**MICROGRAVITY AND THE ORGANISM - RESULTS OF THE SPACELAB-MISSION D1**

D. VOLKMANN (Bonn, Universitaet, Federal Republic of Germany) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 363-365. refs

Results of the D1 Spacelab mission in the fields of cell, developmental, and gravitational biology are summarized. Microgravity effects noted include, for single-cell systems, enhanced cell proliferation and reduced mitogen-induced activation of lymphocytes, and for certain tissue cultures, the enhancement of embryogenesis. Results have also been obtained on the sensitivity of organisms toward gravity, the involvement of gravity in complicated biological mechanisms such as the circadian rhythm, and adaptation mechanisms under microgravity. R.R.

A88-27690**EFFECT OF MICROGRAVITY ON LYMPHOCYTE ACTIVATION**

A. COGOLI, B. BECHLER (Zuerich, Eidgenoessische Technische Hochschule, Zurich, Switzerland), O. MUELLER, and E. HUNZINGER (Bern, Universitaet, Switzerland) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 366-375. Research supported by the Eidgenoessische Technische Hochschule Zurich. refs
(Contract SNSF-3,382,0,82)

Two experiments related to the study of human lymphocyte activation by the mitogen concanavalin A (con A) in microgravity have been performed in the ESA Biorack on the Spacelab D1 mission. In the first experiment, lymphocyte activation was tested on whole-blood cultures prepared from four crew members prior to, during, and after flight. In the second experiment, lymphocytes were purified from fresh human blood prior to launch, resuspended in culture medium, and exposed in-flight to con A. The results indicate that lymphocytes triggered by con A to be transformed from resting into activated cells are particularly influenced by microgravity conditions, leading to an impairment in lymphocyte efficiency. R.R.

A88-27691**THE 'PARAMECIUM EXPERIMENT' DEMONSTRATION OF A ROLE OF MICROGRAVITY ON CELL**

H. PLANEL, G. RICHOLLEY, R. TIXADOR, J. TEMPLIER, J. C. BES (Toulouse III, Universite, France) et al. IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 376-381. refs

Previous experiments have shown that space flights resulted in an increased proliferative activity of *Paramecium tetraurelia*. The *Paramecium* experiment of the Biorack program confirmed previous findings and gave evidence that the stimulating effect of space flight on proliferation of *Paramecium tetraurelia* was due to microgravity. This conclusion is given by comparison between controls, Og, and centrifuged in-flight cultures. Author

A88-27692**EFFECT OF MICROGRAVITY ON HYBRIDOMA MAMMALIAN CELL BEHAVIOUR**

M. BOUTEILLE, C. BEAURE D'AUGERES, J. ARNOULT, W. BRIEGLEB, J. BUREAU (Paris VI, Universite, France) et al. IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 382-384.

Results obtained with the Spacelab Biorack on the D1 mission regarding the effects of weightlessness on the behavior and/or structure of AM2 mouse hybridoma strain cells are reported. Only moderate changes in the ultrastructural distribution of cellular components were noted under microgravity. Cell proliferation was found to be sensitive to the flight conditions, with 15 percent fewer hybridoma plasma cells found for conditions of zero gravity in comparison with controls. Following the flight, these cells were shown to be capable of resuming a normal growth rate. R.R.

A88-27693 Hamburg Univ. (West Germany).**THE BEHAVIOUR OF THE CIRCADIAN CLOCK OF CHLAMYDOMONAS REINHARDII IN SPACE**

D. MERGENHAGEN and E. MERGENHAGEN (Hamburg, Universitaet, Federal Republic of Germany) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 384-395. BMFT-ESA-NASA-supported research. refs

The overt circadian rhythm in a wildtype (wt+) and a short period (s-) strain of *Chlamydomonas reinhardtii* was studied in space using the photoaccumulation behavior as the recorded parameter. The period of the wt+ was 29.6 hours, of the s- 21.4 hours and did not deviate significantly from ground controls performed exactly at the same time. The phase was delayed in space by 4.2 hours in the wt+, but was not altered in the s-. In both strains the amplitude was significantly higher in space than in the ground controls. During the recording period of 6.5 days, the cell density increased in both strains. The survival rate, i.e., the ability to form colonies on agar petri dishes, was higher in space than on ground. The period was in both strains by 1.1 hours longer in Florida in both the flight and the control samples than in Europe. The significance of these results is discussed with respect to the endogenous nature of the biological clock and the role of the microgravity environment. Author

A88-27694 Centre Hospitalier Univ. Rangueil, Toulouse (France).**ANTIBACTERIAL ACTIVITY OF ANTIBIOTICS IN SPACE CONDITIONS**

L. LAPCHINE, N. MOATTI (Centre Hospitalier Universitaire Rangueil, Toulouse, France), G. RICHOLLEY, J. TEMPLIER, G. GASSET (Toulouse III, Universite, France) et al. IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 395-397. CNES-NASA-ESA-supported research. refs

The antibacterial activity of the antibiotic Colistin in space was investigated during the Antibio experiment on Spacelab mission D1. An increase in the minimal inhibitory concentration (the minimal quantity of antibiotic which stops bacterial growth) was found in cultures developed in vitro during the space flight, confirming previous findings of an increase in antibiotic resistance of bacteria cultivated in microgravity conditions. Theories which explain the phenomenon as an adaptation to weightlessness are explored. R.R.

A88-27695**GROWTH AND DIFFERENTIATION OF BACILLUS SUBTILIS UNDER MICRO-GRAVITY**

H. D. MENNIGMANN and M. LANGE (Frankfurt, Universitaet, Frankfurt am Main, Federal Republic of Germany) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings . Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 398-403. BMFT-supported research. refs

The growth and sporulation of *Bacillus subtilis* under microgravity was experimentally studied on Spacelab mission D1. The experimental methods and hardware are described, and the resulting growth curves are shown. The results show that the organism grows faster and yields more biomass under microgravity. C.D.

A88-27696**EFFECTS OF MICROGRAVITY ON GENETIC RECOMBINATION IN ESCHERICHIA COLI**

O. CIFERRI (Embassy of Italy, Ottawa, Canada), O. TIBONI, G. DI PASQUALE, A. M. ORLANDONI, and M. L. MARCHESI (Pavia, Universita, Italy) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings . Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 403-408. refs

The effects of microgravity on the processes for genetic recombination in *Escherichia coli* were evaluated during the Spacelab D-1 Mission. Whereas no effect was observed in the case of transformation and transduction, microgravity exerted a positive effect on conjugation. Indeed, as compared to the controls both on flight and on ground, under microgravity the number of conjugative recombinants was the same for the first marker but three to four-fold higher for the second and the third markers. These results suggest that, in microgravity, the frequency of mating interruptions is decreased resulting in an enhancement of DNA transfers. Author

A88-27697**CONTRACTION BEHAVIOUR - AND PROTOPLASMIC STREAMING IN THE SLIME MOLD PHYSARUM POLYCEPHALUM - PHYSARUM KINETICS**

I. BLOCK, W. BRIEGLEB, V. SOBICK (DFVLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany), and K. E. WOHLFARTH-BITTERMANN (Bonn, Universitaet, Federal Republic of Germany) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings . Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 408-418. refs

D1-mission Biorack experiments have been conducted on *Physarum polycephalum* in order to investigate the possibility of a general gravisensitivity in cells that are not specialized for the perception of gravity. The results show a general gravisensitivity in these cells, and the strong oscillations of the periods in the *Physarum* experiment suggest an active compensation mechanism. Results obtained for *Physarum* on a fast-rotating clinostat confirm the findings and indicate that the receptor site of the gravisensitivity may be correlated with the mitochondria. R.R.

A88-27698**OBSERVATIONS ON STRUCTURE AND FUNCTION OF THE GRAVIRECEPTOR IN A VERTEBRATE (XENOPUS LAEVIS D.) EXPOSED TO NEAR WEIGHTLESSNESS**

J. NEUBERT, W. BRIEGLEB, A. SCHATZ, B. KRUSE (DFVLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany), and I. HERTWIG (Bonn, Universitaet, Federal Republic of Germany) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings . Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 423-430. refs

The structure and function of gravireceptors in growing frog embryos and larvae (*Xenopus laevis*) exposed to conditions of near weightlessness for 7 days aboard the Shuttle Challenger were investigated. The more or less normal shape and arrangement of the otolith membranes of the flown *Xenopus* larvae revealed by TEM and SEM studies confirms the autonomy of the formation mechanism of the otolith membranes with respect to gravity. Other findings include an otolith-like formation below the dorsal wall of the vestibulum, the lack of effect of cosmic radiation on the embryonic development of flown *Xenopus* eggs, and the typical anomaly of loop-swimming behavior of the tadpoles one hour after landing. R.R.

A88-27699**THE ROLE OF GRAVITY IN THE ESTABLISHMENT OF THE DORSO/VENTRAL AXIS IN THE AMPHIBIAN EMBRYO**

G. A. UBBELS (International Embryological Institute, Utrecht, Netherlands) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings . Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 431-437. Research supported by the Nederlands Instituut voor Vlieguitontwikkeling en Ruimtevaart. refs

An experimental attempt to fertilize frog eggs in space and thereby learn about the role of gravity in the establishment of the dorso/ventral axis in these animals is reported. The animal culture, induction of spawning, loading of experimental containers, and experimental schedule are described. The fertilization and gastrulation of eggs is discussed, and the performance of the hardware is addressed. C.D.

A88-27700**BIORACK EXPERIMENT FLY 15 - MICROGRAVITY AND OTHER EFFECTS OF SHORT SPACEFLIGHTS ON DROSOPHILA MELANOGASTER EMBRYOGENESIS AND LIFE SPAN**

J. GONZALEZ-JURADO, I. VERNOS, M. CALLEJA, M. CARRATALA, and R. MARCO (Consejo Superior de Investigaciones Cientificas, Instituto de Investigaciones Biomedicas; Madrid, Universidad Autonoma, Spain) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings . Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 438-445. Research supported by the Comision Nacional de Investigacion del Espacio. refs

The effects of a space environment on animal development and aging was studied by flying 240 female and 90 male wild-type Oregon R *Drosophila melanogaster* flies in the Space Shuttle. The ESA Biorack facility was utilized. Compared to controls, microgravity caused increased oocyte production and a significant decrease in the number of larvae hatched from embryonic cuticles. There was a delay in the development to adults from embryos and larvae subjected to microgravity. At least 25 percent of the living embryos recovered from space failed to develop into adults, and the life spans of the adult males exposed continuously to microgravity was shortened to 0.75 of control life spans, while the life spans of females seemed to be unaffected by the short exposure to the space environment. No significant accumulations of lethal mutations were detected in the experiments. C.D.

51 LIFE SCIENCES (GENERAL)

A88-27701

EMBRYOGENESIS AND ORGANOGENESIS OF CARAUSIUS MOROSUS UNDER SPACEFLIGHT CONDITIONS

H. BUECKER, R. FACIUS, G. HORNECK, G. REITZ (DFVLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany), E. H. GRAUL (Marburg, Klinikum der Universitaet, Federal Republic of Germany) et al. IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 446-453. BMFT-supported research. refs

The influence of cosmic radiation and/or microgravity on insect development was studied during the seven-day German Spacelab Mission D1 using eggs of *Carausius morosus*. The early stages of egg development were highly sensitive to single hits of cosmic ray particles as well as to the temporary exposure to microgravity. Hits by single HZE particles caused early effects such as body anomalies and late effects such as retarded growth after hatching. Microgravity exposure led to a reduced hatching rate. A synergistic effect of HZE particle hits and microgravity was established in the unexpectedly high frequency of anomalous larvae. C.D.

A88-27702

GRAVIPERCEPTION OF CRESS ROOTS (LEPIDIUM SATIVUM L.) - ROOT DEVELOPMENT, GRAVITY SENSING, AND ULTRASTRUCTURE OF PERCEIVING CELLS UNDER MICROGRAVITY ENVIRONMENT

H. M. BEHRENS, D. VOLKMANN, and A. SIEVERS (Bonn, Universitaet, Federal Republic of Germany) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 454-462. BMFT-supported research. refs

A88-27703

GRAVIREACTION OF LENTIL ROOTS GROWN IN SPACE

G. PERBAL, D. DRISS-ECOLE, G. SALLE (Paris VI, Universite, France), and J. RAFFIN (CNES, Toulouse, France) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 462-465. refs

The association of statoliths and endoplasmic reticulum (ER) in root cap statocytes may play a role in the induction of the gravitropic response, or it may regulate gravitropic curvature. An experimental attempt is reported to dissociate the complex of statoliths and ER by growing lentil roots in microgravity is reported. The roots were stimulated on a centrifuge in order to determine if they were still capable of curvature. After 25 or 35 hr of exposure to microgravity, the direction of growth was found to differ strongly from the initial orientation. The statocytes had normal cell polarity except for the statoliths, which had almost no contact with the ER. The statocytes could sense centrifugal acceleration, as they normally detect gravity. C.D.

A88-27704

BIOTEX - AN ELEMENT FOR THE NEXT GENERATION OF MICROGRAVITY MISSIONS

W. STEINBORN, U. FRIEDRICH, G. HEY (DFVLR, Cologne, Federal Republic of Germany), S. WALTHER, I. ENGELN (MBB-ERNO Raumfahrttechnik GmbH, Bremen, Federal Republic of Germany) et al. IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 465-472. BMFT-supported research. refs

The role of Biotex in the context of German microgravity research is discussed. Present efforts and results available to date are reviewed, and the scientific and technological objectives of Biotex are described. A list of experiments involving Biotex is presented, including the investigators involved. Experiments aboard

the D-2 Mission involving Biotex are examined, including the hardware. C.D.

A88-27745

DNA INSTABILITY AND DELAYED EFFECTS OF IRRADIATION [NESTABIL'NOST' DNK I OTDALENNYE POSLEDSTVIA VOZDEISTVIA IZLUCHEENII]

MIKHAIL MARKOVICH VILENCHIK Moscow, Energoatomizdat, 1987, 192 p. In Russian. refs

This book discusses the mechanisms of the delayed carcinogenic effects of ionizing radiation. It is emphasized that, while the short-term effects of radiation involve DNA damage directly, the long-term effects result from radiation-induced damage to cellular DNA-repair systems, which decreases the efficiency of enzymatic DNA repair and thus increases the degree of DNA instability. It is shown that the radiation-induced mechanisms of interference with spontaneous DNA repair are similar to the mechanisms responsible for increased DNA instability caused by such physiological factors as advanced age, disease, and certain genetic disorders. I.S.

A88-28151

EFFECT OF ELEUTHEROCOCCUS ON THE FUNCTIONAL STATE OF THE ANTICOAGULATORY SYSTEM IN OLD ANIMALS [VLIANIE ELEUTEROKOKKA NA FUNKTSIONAL'NOE SOSTOIANIE PROTIVOSVERTYVAIUSHCHEI SISTEMY STARYKH ZHIVOTNYKH]

L. A. LIAPINA, V. E. PASTOROVA, E. G. ZVEREVA (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR), and G. G. BAZAZ'IAN Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 73, Oct. 1987, p. 1390-1395. In Russian. refs

The effect of pretreatment of old (18-20 months) rats with 1 percent *Eleutherococcus* preparation in alcohol (at 0.5 ml/300 g doses) on the activity of the anticoagulatory system was investigated in rats kept at control conditions, noise-stressed (by a 120-dB bell sound for 1.5 min), or injected with thromboplastin. It was found that, in comparison with rats injected only with alcohol, rats injected with *Eleutherococcus* for 30 days exhibited considerable activation of the fibrinolytic system in both control and noise-stressed conditions. Thirty-day treatment with *Eleutherococcus* was also found to protect rats against possible thromboplastin-induced coagulation. However, 60-day treatment with *Eleutherococcus* resulted in decreased protection of thromboplastin-injected rats. It is suggested that prolonged injections with alcohol could have nullified the protective effect of *Eleutherococcus*. I.S.

A88-28627* Rice Univ., Houston, Tex.

HYDRODYNAMIC EFFECTS ON CELLS IN AGITATED TISSUE CULTURE REACTORS

R. S. CHERRY and E. T. PAPOUTSAKIS (Rice University, Houston, TX) Bioprocess Engineering (ISSN 0178-515X), vol. 1, 1986, p. 29-41. refs
(Contract NAS9-17403)

The mechanisms by which hydrodynamic forces can affect cells grown on microcarrier beads in agitated cell culture reactors were investigated by analyzing the motion of microcarriers relative to the surrounding fluid, to each other, and to moving or stationary solid surfaces. It was found that harmful effects on cell cultures that have been previously attributed to shear can be better explained as the effects of turbulence (of a size scale comparable to the microcarriers or the spacing between them) or collisions. The primary mechanisms of cell damage involve direct interaction between microcarriers and turbulent eddies, collisions between microcarriers in turbulent flow, and collisions against the impeller or other solid surfaces. The implications of these analytical results for the design of tissue culture reactors are discussed. I.S.

A88-28687* Wisconsin Univ., Madison.

TREATMENT OF TRYPANOSOME-INFECTED MICE WITH EXOGENOUS INTERFERON, INTERFERON INDUCERS, OR ANTIBODY TO INTERFERON

ANTONIE L. W. DEGREE, JOHN M. MANSFIELD (Wisconsin, University, Madison), and GERALD SONNENFELD (Louisville, University, KY) *Journal of Parasitology* (ISSN 0022-3395), vol. 72, Oct. 1986, p. 792-794.

(Contract NIH-AI-22441; NCC2-213)

Earlier studies have demonstrated that mice resistant to *Trypanosoma brucei rhodesiense* (the B10.BR/SgSnJ strain) produces, upon infection by this parasite, two peaks of serum interferon (IFN), while the susceptible mice (C3HeB/FeJ) produces no IFN. In the present study, survival times were compared for B10.BR/SgSnJ, C3HeB/FeJ, and CBA/J (an intermediately resistant strain) mice that were injected, prior to infection with the parasite, with either of the following three preparations (1) IFN-gamma, (2) an antibody to IFN-gamma and (3) polyriboinosinic-polyribocytidylic acid (to induce IFN-alpha/beta). No effect on the survival times of mice by any of these preparations could be demonstrated, contrary to some previous reports. I.S.

A88-28688* Rockefeller Univ., New York.

CONTROL OF ABDOMINAL MUSCLES BY BRAIN STEM RESPIRATORY NEURONS IN THE CAT

ALAN D. MILLER, KAZUHISA EZURE, and ICHIRO SUZUKI (Rockefeller University, New York) *Journal of Neurophysiology* (ISSN 0022-3077), vol. 54, July 1985, p. 155-167. refs

(Contract NAG2-164; NSG-2380; NSF BNS-83-17651; NIH-NS-02619; NIH-RR-07065)

The nature of the control of abdominal muscles by the brain stem respiratory neurons was investigated in decerebrate unanesthetized cats. First, it was determined which of the brain stem respiratory neurons project to the lumbar cord (from which the abdominal muscles receive part of their innervation), by stimulating the neurons monopolarily. In a second part of the study, it was determined if lumbar-projecting respiratory neurons make monosynaptic connections with abdominal motoneurons; in these experiments, discriminate spontaneous spikes of antidromically activated expiratory (E) neurons were used to trigger activity from both L1 and L2 nerves. A large projection was observed from E neurons in the caudal ventral respiratory group to the contralateral upper lumbar cord. However, cross-correlation experiments found only two (out of 47 neuron pairs tested) strong monosynaptic connections between brain stem neurons and abdominal motoneurons. I.S.

A88-28690* Pennsylvania State Univ., University Park.

A STUDY OF CELL ELECTROPHORESIS AS A MEANS OF PURIFYING GROWTH HORMONE SECRETING CELLS

LINDSAY D. PLANK, W. C. HYMER, M. ELAINE KUNZE, GARY M. MARKS (Pennsylvania State University, University Park), and J. WAYNE LANHAM (McDonnell Douglas Astronautics Co., Electrophoresis Operations in Space Div., Saint Louis, MO) *Journal of Biochemical and Biophysical Methods* (ISSN 0165-022X), vol. 8, 1983, p. 275-289. refs

(Contract NAS9-15566; NAS9-15584)

Growth hormone secreting cells of the rat anterior pituitary are heavily laden with granules of growth hormone and can be partially purified on the basis of their resulting high density. Two methods of preparative cell electrophoresis were investigated as methods of enhancing the purification of growth hormone producing cells: density gradient electrophoresis and continuous flow electrophoresis. Both methods provided a two- to four-fold enrichment in growth hormone production per cell relative to that achieved by previous methods. Measurements of electrophoretic mobilities by two analytical methods, microscopic electrophoresis and laser-tracking electrophoresis, revealed very little distinction between unpurified anterior pituitary cell suspensions and somatotroph-enriched cell suspensions. Predictions calculated on the basis of analytical electrophoretic data are consistent with the hypothesis that sedimentation plays a significant role in both types of preparative electrophoresis and the electrophoretic mobility of

the growth hormone secreting subpopulation of cells remains unknown. Author

A88-28693* Rockefeller Univ., New York.

INNERVATION OF PERIESOPHAGEAL REGION OF CAT'S DIAPHRAGM - IMPLICATION FOR STUDIES OF CONTROL OF VOMITING

L. K. TAN and A. D. MILLER (Rockefeller University, New York) *Neuroscience Letters* (ISSN 0304-3940), vol. 68, 1986, p. 339-344. refs

(Contract NSF BNS-83-17651; NAG2-164; NSG-2380; NIH-NS-20585; NIH-RR-07065)

The extent of the region of the diaphragm around the esophagus that displays greatly reduced activity during the expulsive phase of vomiting was determined from electromyographic studies in cats to be about 0.75-1.0 cm from the esophagus. Horseradish peroxidase injected into this region retrogradely labeled motoneurons throughout most of the rostral-caudal extent of the phrenic nucleus, with the exception of caudal C6 and rostral C7. This widespread intermingling of motoneurons that innervate the region of reduced activity with other phrenic motoneurons creates a difficulty for needed follow-up studies of diaphragmatic control during vomiting. Author

A88-28699* Louisville Univ., Ky.

ENHANCEMENT OF VIRAL PATHOGENESIS IN MICE MAINTAINED IN AN ANTIORTHOSTATIC SUSPENSION MODEL - COORDINATION WITH EFFECTS ON INTERFERON PRODUCTION

C. L. GOULD (Community Blood Center, Dayton, OH) and G. SONNENFELD (Louisville, University, KY) *Journal of Biological Regulators and Homeostatic Agents* (ISSN 0393-974X), vol. 1, no. 1, 1987, p. 33-36. refs

(Contract NCC2-213)

Both rodents and men returning from spaceflight have exhibited alterations in immune responses and, in particular, interferon production. This work utilizes a model for antiorthostatic (20-deg head-down tilt), hypokinetic, hypodynamic suspension of mice that simulates some aspects of weightlessness. Female Swiss/Webster mice that are normally resistant to infection with the D variant of encephalomyocarditis virus showed a marked increase in susceptibility to infection when suspended. This correlated with a drop in interferon production. Control, orthostatically suspended mice (no tilt) showed no increase in susceptibility to the virus. Author

A88-28700* Louisville Univ., Ky.

EFFECT OF TREATMENT WITH INTERFERON-GAMMA AND CONCANAVALIN A ON THE COURSE OF INFECTION OF MICE WITH SALMONELLA TYPHIMURIUM STRAIN LT-2

CHERYL L. GOULD and GERALD SONNENFELD (Louisville, University, KY) *Journal of Interferon Research* (ISSN 0197-8357), vol. 7, 1987, p. 255-260. refs

(Contract NCC2-213)

The effect of pretreatment of mice with 34 units/day, for five days, of interferon-gamma (IFN-gamma) on the course of infection with LD50 of *Salmonella typhimurium* strain LT-2 was assessed, using two IFN preparations: (1) a hybridoma supernatant fluid containing concanavalin-A-induced IFN-gamma activity and (2) pure murine IFN-gamma produced by recombinant DNA technology. The hybridoma supernatant-treated *Salmonella*-infected mice were found to die faster than mice treated only with *Salmonella*. Pure murine IFN-gamma was found to protect infected mice significantly, with 95 percent of mice surviving LD50 infection. In contrast, the *Salmonella*-infected mice treated with hybridoma supernatant were found to die faster than the *Salmonella*-infected untreated controls. Mice treated with concanavalin A alone prior to infection with *S. typhimurium* died more quickly than the untreated infected controls, suggesting that contamination with concanavalin A had a detrimental effect on mice survival. I.S.

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A88-28701* Louisville Univ., Ky.

TRYPANOSOMA BRUCEI RHODESIENSE INFECTION IN MICE PREVENTS VIRUS-INDUCED DIABETES - POSSIBLE ROLE OF INTERFERON AND IMMUNOLOGICAL MECHANISMS

CHERYL L. GOULD, GERALD SONNENFELD (Louisville, University, KY), ANTONIE L. W. DEGEER, and JOHN M. MANSFIELD (Wisconsin, University, Madison) *Journal of Interferon Research* (ISSN 0197-8357), vol. 6, 1986, p. 499-506. refs (Contract NCC2-213; NIH-AI-22441; NIH-RR-05375)

A88-28708

EFFECT OF STRESS AND GLUCOCORTICOIDS ON THE GASTROINTESTINAL CHOLINERGIC ENZYMES

E. T. ORIAKU and K. F. A. SOLIMAN (Florida A & M University, Tallahassee) *Archives Internationales de Pharmacodynamie et de Therapie* (ISSN 0003-9780), vol. 280, March 1986, p. 136-144. refs

Male rats have been exposed to acute cold and immobilization stress for 1 hour, exposed to cold stress for 7 days, or treated with corticosterone 1 hr, prior to sacrificing with their controls; their stomachs, duodenum, ileums, and colons were then separated and assayed for choline acetyltransferase (ChAT) and acetylcholinesterase (AChE) activities. It is found that exposure to acute stress resulted in a significant decline of ChAT activity in all tissues studied. Acute stress caused significant increase in AChE activity in all tissues except for the ileum and the stomach. O.C.

A88-28709* Cornell Univ., New York, N.Y.

SPECIFIC IMMUNIZATION OF MICE AGAINST LEISHMANIA MEXICANA AMAZONENSIS USING SOLUBILIZED PROMASTIGOTES

M. BARRAL-NETTO, M. SADIGURSKY (Centro de Pesquisas Gonçalo Moniz, Salvador, Brazil), S. G. REED (Cornell University, New York; Louisville, University, KY), and G. SONNENFELD (Louisville, University, KY) *Clinical and Experimental Immunology* (ISSN 0009-9104), vol. 67, 1987, p. 11-19. CNPq-supported research. refs (Contract PHS-16282; NCC2-213)

In this work, it was demonstrated that mice (BALB/c strain) highly susceptible to *Leishmania mexicana amazonensis* can be protected against infection by this parasite by being preimmunized with whole solubilized (in a buffer that contained EDTA, NP-40, and SDS) promastigotes; the use of adjuvant or intact inactivated parasite cells is shown to be not necessary. The best immunization schedule consisted of three intravenous injections of 5×10^6 to the 7th parasite equivalents, administered one to eight weeks before infection. Immunized mice exhibited a marked inhibition of primary lesion development, reduced numbers of parasites in the spleen, and reduced death rate. I.S.

N88-17168*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SPACE BIOREACTOR SCIENCE WORKSHOP

DENNIS R. MORRISON, ed. Dec. 1987 183 p Workshop held in Houston, Tex., 22-23 Aug. 1985 (NASA-CP-2485; S-564; NAS 1.55:2485) Avail: NTIS HC A09/MF A01 CSCL 06B

The first space bioreactor has been designed for microprocessor control, no gaseous headspace, circulation and resupply of culture medium, and a slow mixing in very low shear regimes. Various ground based bioreactors are being used to test reactor vessel design, on-line sensors, effects of shear, nutrient supply, and waste removal from continuous culture of human cells attached to microcarriers. The small (500 ml) bioreactor is being constructed for flight experiments in the Shuttle middeck to verify systems operation under microgravity conditions and to measure the efficiencies of mass transport, gas transfer, oxygen consumption, and control of low shear stress on cells. Applications of microcarrier cultures, development of the first space bioreactor flight system, shear and mixing effects on cells, process control, and methods to monitor cell metabolism and nutrient requirements are among the topics covered.

N88-17169*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SUSPENSION CELL CULTURE IN MICROGRAVITY AND DEVELOPMENT OF A SPACE BIOREACTOR

DENNIS R. MORRISON *In its Space Bioreactor Science Workshop* p 1-18 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

NASA has methodically developed unique suspension type cell and recovery apparatus culture systems for bioprocess technology experiments and production of biological products in microgravity. The first space bioreactor has been designed for microprocessor control, no gaseous headspace, circulation and resupply of culture medium, and slow mixing in very low shear regimes. Various ground based bioreactors are being used to test reactor vessel design, on-line sensors, effects of shear, nutrient supply, and waste removal from continuous culture of human cells attached to microcarriers. The small (500 ml) bioreactor is being constructed for flight experiments in the Shuttle middeck to verify systems operation under microgravity conditions and to measure the efficiencies of mass transport, gas transfer, oxygen consumption, and control of low shear stress on cells. Author

N88-17170*# Technology, Inc., Houston, Tex.

SPACE BIOREACTOR: DESIGN/PROCESS FLOW

JOHN H. CROSS *In NASA. Lyndon B. Johnson Space Center, Space Bioreactor Science Workshop* p 19-27 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

The design of the space bioreactor stems from three considerations. First, and foremost, it must sustain cells in microgravity. Closely related is the ability to take advantage of the weightlessness and microgravity. Lastly, it should fit into a bioprocess. The design of the space bioreactor is described in view of these considerations. A flow chart of the bioreactor is presented and discussed. Author

N88-17171*# Technology, Inc., Houston, Tex.

BIOREACTOR DESIGN CONCEPTS

WILLIAM BOWIE *In NASA. Lyndon B. Johnson Space Center, Bioreactor Science Workshop* p 29-39 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

Two parallel lines of work are underway in the bioreactor laboratory. One of the efforts is devoted to the continued development and utilization of a laboratory research system. That system's design is intended to be fluid and dynamic. The sole purpose of such a device is to allow testing and development of equipment concepts and procedures. Some of the results of those processes are discussed. A second effort is designed to produce a flight-like bioreactor contained in a double middeck locker. The result of that effort has been to freeze a particular bioreactor design in order to allow fabrication of the custom parts. The system is expected to be ready for flight in early 1988. However, continued use of the laboratory system will lead to improvements in the space bioreactor. Those improvements can only be integrated after the initial flight series. Author

N88-17172*# Technology, Inc., Houston, Tex.

COMPUTER CONTROL OF A MICROGRAVITY MAMMALIAN CELL BIOREACTOR

WILLIAM A. HALL *In NASA. Lyndon B. Johnson Space Center, Space Bioreactor Science Workshop* p 41-57 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

The initial steps taken in developing a completely menu driven and totally automated computer control system for a bioreactor are discussed. This bioreactor is an electro-mechanical cell growth system cell requiring vigorous control of slowly changing parameters, many of which are so dynamically interactive that computer control is a necessity. The process computer will have two main functions. First, it will provide continuous environmental control utilizing low signal level transducers as inputs and high powered control devices such as solenoids and motors as outputs. Secondly, it will provide continuous environmental monitoring, including mass data storage and periodic data dumps to a supervisory computer. Author

N88-17173*# Rice Univ., Houston, Tex. Dept. of Chemical Engineering.

SHEAR AND MIXING EFFECTS ON CELLS IN AGITATED MICROCARRIER TISSUE CULTURE REACTORS

ROBERT S. CHERRY and E. TERRY PAPOUTSAKIS *In* NASA. Lyndon B. Johnson Space Center, Space Bioreactor Science Workshop p 59-75 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

Tissue cells are known to be sensitive to mechanical stresses imposed on them by agitation in bioreactors. The amount of agitation provided in a microcarrier or suspension bioreactor should be only enough to provide effective homogeneity. Three distinct flow regions can be identified in the reactor: bulk turbulent flow, bulk laminar flow and boundary-layer flows. Possible mechanisms of cell damage are examined by analyzing the motion of microcarriers or free cells relative to the surrounding fluid, to each other and to moving or stationary solid surfaces. The primary mechanisms of cell damage appear to result from: (1) direct interaction between microcarriers and turbulent eddies; (2) collisions between microcarriers in turbulent flow; and (3) collisions against the impeller or other stationary surfaces. If the smallest eddies of turbulent flow are of the same size as the microcarrier beads, they may cause high shear stresses on the cells. Eddies the size of the average interbead spacing may cause bead-bead collisions which damage cells. The severity of the collisions increases when the eddies are also of the same size as the beads. Impeller collisions occur when beads cannot avoid the impeller leading edge as it advances through the liquid. The implications of the results of this analysis on the design and operation of tissue culture reactors are discussed. Author

N88-17174*# Houston Univ., Tex. Dept. of Chemical Engineering.

SOME PROCESS CONTROL/DESIGN CONSIDERATIONS IN THE DEVELOPMENT OF A MICROGRAVITY MAMMALIAN CELL BIOREACTOR

CHARLES F. GOOCHEE *In* NASA. Lyndon B. Johnson Space Center, Space Bioreactor Science Workshop p 77-91 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

The purpose is to review some of the physical/metabolic factors which must be considered in the development of an operating strategy for a mammalian cell bioreactor. Emphasis is placed on the dissolved oxygen and carbon dioxide requirements of growing mammalian epithelial cells. Literature reviews concerning oxygen and carbon dioxide requirements are discussed. A preliminary, dynamic model which encompasses the current features of the NASA bioreactor is presented. The implications of the literature survey and modeling effort on the design and operation of the NASA bioreactor are discussed. Author

N88-17175*# BioChem Technology, Inc., Malvern, Pa. **FED-BATCH CONTROL BASED UPON THE MEASUREMENT OF INTRACELLULAR NADH**

W. B. ARMIGER, J. F. LEE, L. M. MONTALVO, and J. R. FORRO *In* NASA. Lyndon B. Johnson Space Center, Space Bioreactor Science Workshop p 93-103 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

A series of experiments demonstrating that on-line measurements of intracellular NADH by culture fluorescence can be used to monitor and control the fermentation process are described. A distinct advantage of intercellular NADH measurements over other monitoring techniques such as pH and dissolved oxygen is that it directly measures real time events occurring within the cell rather than changes in the environment. When coupled with other measurement parameters, it can provide a finer degree of sophistication in process control. Author

N88-17176*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

NUTRIENT REQUIREMENTS AND OTHER FACTORS INVOLVED IN THE CULTURE OF HUMAN KIDNEY CELLS ON MICROCARRIER BEADS

MARIAN L. LEWIS (Technology, Inc., Houston, Tex.) and DENNIS R. MORRISON *In* its Space Bioreactor Science Workshop p 105-119 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

The culture of human kidney cells on microcarrier beads in the Bioprocessing Laboratory at the Johnson Space Center is described. These were the first series of studies performed before and during 1983 to determine optimum conditions, including medium type, bead type and density. The composition of several medium types and the molecular weights of some common culture medium supplements and cellular proteins are included. The microgravity cell-to-bead attachment experiment performed on Space Transportation System Flight 8 is described. Author

N88-17177*# State Univ. of New York, Stony Brook. Dept. of Biochemistry.

PLANT CELL TECHNOLOGIES IN SPACE: BACKGROUND, STRATEGIES AND PROSPECTS

A. D. KIRKORIAN and H. W. SCHELD (Phytoresource Research, Inc., College Station, Tex.) *In* NASA. Lyndon B. Johnson Space Center, Space Bioreactor Science Workshop p 121-144 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

An attempt is made to summarize work in plant cell technologies in space. The evolution of concepts and the general principles of plant tissue culture are discussed. The potential for production of high value secondary products by plant cells and differentiated tissue in automated, precisely controlled bioreactors is discussed. The general course of the development of the literature on plant tissue culture is highlighted. Author

N88-17178*# Lovelace Biomedical and Environmental Research Inst., Albuquerque, N. Mex. Div. of Biomedical Research.

POTENTIAL USE OF THE BIOREACTOR TO DETERMINE EFFECTS OF MICROGRAVITY AND OTHER ENVIRONMENTAL PARAMETERS ON GROWTH OF HYBRIDOMA CELLS

KENNETH D. LEY *In* NASA. Lyndon B. Johnson Space Center, Space Bioreactor Science Workshop p 145-146 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

It is argued that the bioreactor being developed at NASA will allow researchers to determine the optimal conditions (e.g., pH, O₂, CO₂, nutrients) for growth of hybridoma cells, and to determine whether cell growth and antibody production are enhanced in the microgravity of space. Author

N88-17179*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DESIGN CONCEPTS FOR BIOREACTORS IN SPACE

P. K. SESHAN, G. R. PETERSON, B. BEARD, C. BOSHE, and E. H. DUNLOP (Washington Univ., Seattle.) *In* NASA. Lyndon B. Johnson Space Center, Space Bioreactor Science Workshop p 147-159 Dec. 1987 Previously announced as N86-19926

Avail: NTIS HC A09/MF A01 CSCL 06B

Microbial food sources are becoming viable and more efficient alternatives to conventional food sources, especially in the context of closed ecological life support systems (CELSS) in space habitats. Two bioreactor design concepts presented represent two dissimilar approaches to grappling with the absence of gravity in space habitats and deserve to be tested for adoption as important components of the life support function aboard spacecraft, space stations and other extra-terrestrial habitats. R.J.F.

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N88-17180*# Technology, Inc., Houston, Tex. CELL CULTURE EXPERIMENTS PLANNED FOR THE SPACE BIOREACTOR

DENNIS R. MORRISON and JOHN H. CROSS /in NASA. Lyndon B. Johnson Space Center, Space Bioreactor Science Workshop p 161-178 Dec. 1987

Avail: NTIS HC A09/MF A01 CSCL 06B

Culturing of cells in a pilot-scale bioreactor remains to be done in microgravity. An approach is presented based on several studies of cell culture systems. Previous and current cell culture research in microgravity which is specifically directed towards development of a space bioprocess is described. Cell culture experiments planned for a microgravity sciences mission are described in abstract form. Author

N88-17706*# City Coll. of the City Univ. of New York. Dept. of Science.

DROSOPHILA GEOTAXIS AS A TOOL FOR THE STUDY OF AGING

EDGAR M. SCHNEBEL, R. NICHOLAS HOFFMANN, and JOE GROSSFIELD /in NASA. Goddard Space Flight Center, The 1987 Get Away Special Experimenter's Symposium p 107-113 Feb. 1988

Avail: NTIS HC A08/MF A01 CSCL 06B

Age dependent changes in geotaxis profiles were examined in 27 wild-type populations of *Drosophila*, representing a diversity of species, semispecies and strains. In addition, four strains of *D. melanogaster* were tested. Tests were carried out at a minimum of three test ages, and involve the use of a calibrated, adjustable inclined plane that can be set at any angle between 0 and 85 deg. Among selected lines, decline in geotactic response occurs later in the long lived flies than in the controls. Longer lived flies continue to show an increase in negative geotactic response through age 14 days. These results suggest that common processes may be influencing the rate of decline in geotactic response and longevity. Further analysis of the mechanisms underlying age dependent changes in geotaxis may reveal factors which influence the aging process itself. The use of geotaxis aging markers in a broad range of *Drosophila* species reflecting varying degrees of genetic relatedness is proposed to test the universality vs. specificity of aging processes. Author

N88-18120# Laboratoire d'Heliosynthese BP, Lavera (France). RESEARCH ON A SOLAR BIOTECHNOLOGY BASED ON THE CULTURE OF PHOTOSYNTHETIC CELLS

C. GUDIN, D. CHAUMONT, O. DESANTI, and D. PIOLINE (Societe Francaise des Petroles BP, Courbevoie, France) 1986 42 p In FRENCH; In FRENCH Prepared in cooperation with Societe Francaise des Petroles BP, 92 - Courbevoie (France)

(Contract ESE-R-037-F)
(DE88-900129; EUR-10099) Avail: NTIS (US Sales Only) HC A03

To evaluate the potential offered by different photosynthetic organisms, a study of the growth of *Enteromorpha lincolata* and *Synechocystis* sp. was conducted on a laboratory scale and several trials in batch culture. From a methodological point of view, the batch culture is the easiest way of comparing the growth physiology of two strains of cells. But this method does not permit taking account of the dynamic aspect on which the extrapolation of the trials on a large scale must be based. For this reason, the continuous culture system was chosen to compare the potential of two blue-green algae *Synechocystis* sp. (previously studied in batch system) and *Spirulina maxima*. Results and conclusions of this comparative ecophysiological study of the three strains, each of potential interest, are given. In conclusion, the research carried out in this project shows that the three strains have different behavior, but nevertheless, their specificity permits them to cover a wide range of applications according to the climatic conditions (25°C, 32°C, 42°C) and the nature of the water (polluted, brackish, salted). DOE

N88-18121# California Univ., Berkeley. Lawrence Berkeley Lab.

SPECTROSCOPIC STUDIES OF ENERGY TRANSFER IN PHOTOSYNTHETIC REACTION CENTERS OF HIGHER PLANTS Ph.D. Thesis

S. TABBUTT Sep. 1987 177 p

(Contract DE-AC03-76SF-00098)

(DE88-003850; LBL-24017) Avail: NTIS HC A09/MF A01

The focus of this thesis is excitation transfer and primary photochemistry in spinach chloroplasts and sub-chloroplast particles. The fluorescence kinetics are measured with a synchronously pumped, mode-locked dye laser excitation source and a reverse single photon-counting timing detection system. Very little has been reported on the fluorescence properties of photosystem I (PS I) due to its relatively weak emission compared to photosystem II (PS II). Using a PS I complex isolated from spinach, two emission bands, 690 nm and 722 nm were observed. The 690 nm fluorescence kinetics has an instrument limited (25 ps) rise and is best fit to three exponential decay components: slow, 2.2 to 2.5 ns; middle, 250 to 300 ps; and fast, 40 to 100 ps. Both the yield and kinetics are temperature independent (77 to 295 K). The 722 nm emission is dramatically temperature dependent. At 295 K the fluorescence lifetimes at 720 nm are identical to those at 690 nm. Upon lowering the temperature the lifetimes of all three decay components increase, a measurable risetime (more than 25 ps) grows at temperatures below 265 K, and the fluorescence intensity at 722 nm increases about 20-fold from 295 K to 77 K. These studies provide excitation transfer rates and activation energies within the PS I centers. DOE

N88-18122# Joint Publications Research Service, Arlington, Va. JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 21, NO. 5, SEPTEMBER - OCTOBER 1987

25 Feb. 1988 162 p Transl. into ENGLISH of Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 96 p

(JPRS-USB-88-003) Avail: NTIS HC A08/MF A01

Topics addressed include: effects of space flight; simian circadian rhythms; guppy development in weightlessness; histomorphometric analysis of rats; optokinetic stimulation in vestibulospinal reflexes; vestibular semicircular canal model; carbon monoxide exposure cardiovascular disease in flight personnel; effects of hypokinesia; radiation effects; toxic aspects of sulfur hexafluoride; and stress responses to weightlessness.

N88-18124# Joint Publications Research Service, Arlington, Va. EFFECT OF SPACEFLIGHT FACTORS ON PRIMATE'S BLOOD CIRCULATION

S. V. ABROSIMOV, V. V. ZHIDKOV, D. K. ENDEKA, V. I. LOBACHIK, V. I. KOROLKOV, and YE. A. ILYIN /in its JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 9-14 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 10-13

Avail: NTIS HC A08/MF A01

Using radioactive isotopes, central, peripheral, and organ blood circulation was investigated in two rhesus monkeys before the 7 day space flight, 1.5 hours after touchdown, and 4 months after recovery. Blood distribution and shifts were measured in different body segments, viz. head, chest, abdomen, legs. Postflight measurements revealed a decrease of plasma and blood volume. Postflight measurements also demonstrated changes in cardiac output and stroke volume, decrease of total peripheral resistance, reduction of mean arterial pressure, and a slight increase of heart rate. Pulmonary blood flow velocity and time varied insignificantly and in a different manner. Blood was pooled in the legs. Blood flow velocity in the skin of the upper and lower body decreased while in muscles it increased above the baseline values. Postflight, muscles acted as a hemodynamic blood pool. The tolerance of both monkeys to the tilt test was satisfactory. It can be concluded

that the monkeys tolerated the 7 day space flight well enough.

Author

N88-18125# Joint Publications Research Service, Arlington, Va.
INFLIGHT SIMIAN CIRCADIAN RHYTHMS AND TEMPERATURE HOMEOSTASIS ABOARD COSMOS-1514 BIOSATELLITE

V. YA. KLIMOVITSKIY, A. M. ALPATOV, F. M. SULZMAN, C. A. FULLER, and M. C. MOOREEDE *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 15-22 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 14-18

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In the course of a 5 day space flight of two rhesus monkeys the following parameters were recorded at an interval of 16 min: core body temperature (Tc), skin temperature (Ts), and motor activity (MA). The telemetric Tc sensor was implanted subcutaneously in the right axilla, Ts thermistor was attached to the right ankle, and the piezotape was fixed to the inner side of the vest. Circadian rhythms of Tc varied with a period of 24 hours in one monkey and 25 hours in the other. The daily Tc decreased on the average by 0.5 C, Ts fell immediately after launch and remained close to the lower limit throughout the flight. The Ts amplitude decreased 5-fold. Phases of the circadian rhythms of Ts changed and circadian rhythms of MA remained unchanged and equal to 24 hours.

Author

N88-18126# Joint Publications Research Service, Arlington, Va.
EFFECT OF SPACEFLIGHT FACTORS ON PRIMATE HYDRATION HOMEOSTASIS

V. V. ZHIDKOV, S. V. ABROSIMOV, D. K. ENDEKA, G. I. BORISOV, V. I. LOBACHIK, V. V. KOROLKOV, and YE. A. ILYIN *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 23-27 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 19-22

Avail: NTIS HC A08/MF A01

Using nuclear physics methods, hydration homeostasis of three monkeys flown on Cosmos-1514 and Cosmos-1667 was investigated. Measurements were made before flight, 1.5 hours after touchdown, and during the recovery period. Total water content, extracellular, and tissue fluid volumes were measured and intracellular and interstitial fluid volumes were calculated. Postflight, all the animals showed hydration status changes of similar sign: total water content, intracellular and extracellular fluid volumes decreased. Most significant changes occurred in tissue and interstitial fluid volumes. Hydration status responses to space flight factors were variable and the above changes disappeared in the course of the recovery period. The variations recorded were viewed as adaptive.

Author

N88-18127# Joint Publications Research Service, Arlington, Va.
EMBRYONIC DEVELOPMENT OF GUPPY IN WEIGHTLESSNESS

YE. M. CHERDANTSEVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 28-32 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 22-25

Avail: NTIS HC A08/MF A01

The program of the Cosmos-1514 flight included an experiment, the purpose of which was to study the effect of weightlessness on the embryonic development of the live-bearing guppy: three pregnant females were flown for 5 days. Prelaunch their embryos were at the stage of cerebral vesicle differentiation and somite formation; this implies that the basic stages of organogenesis developed in weightlessness. One female was fixed in Bouin's fluid two days post flight and the second fish was fixed nine days postflight. Fourteen days after flight the third female gave birth to 25 normal fry. Thereafter the fish was mated 6 more times, each

time delivering normal offspring. In addition, the offspring of the second generation was normal. Histological analysis of the embryos that were developing in weightlessness revealed no abnormalities. It can be concluded that weightlessness produced no effect on the fish development, beginning with the stage of the axial complex formation.

Author

N88-18128# Joint Publications Research Service, Arlington, Va.
HISTOMORPHOMETRIC ANALYSIS OF RAT BONES AFTER SPACEFLIGHT ABOARD COSMOS-1667 BIOSATELLITE

A. S. KAPLANSKIY, G. N. DURNOVA, Z. F. SAKHAROVA, and YE. I. ILYINAKAKUYEVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 33-40 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 25-31

Avail: NTIS HC A08/MF A01

Bones of the rats flown on Cosmos-1667 were examined histologically and histomorphometrically. It was found that 7 day exposure to weightlessness led to osteoporosis in the spongy matter of proximal metaphyses of tibia and, although to a lesser extent, in the spongiosa of lumbar vertebrae whereas no signs of osteoporosis were seen in the spongy matter of iliac bones. Osteoporosis in the spongy matter of the above bones developed largely due to the inhibition of the bone neoformation, which was indicated by a decrease in the number and activity of osteoblasts. Increased bone resorption (as shown by a greater number and activity of the osteoclasts) was observed only in the spongy matter of tibial metaphyses. It is emphasized that a reduction of the number of highly active osteoblasts in spongy bones is one of the early signs of inhibition of bone neoformation and development of osteoporosis.

Author

N88-18129# Joint Publications Research Service, Arlington, Va.
EFFECT OF WEIGHTLESSNESS ON REPLICATIVE FUNCTION OF RAT HEPATOCYTE DNA

G. S. KOMOLOVA, A. V. ZAKAZNOV, and V. F. MAKEYEVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 41-45 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 31-34

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The replicative function of DNA of liver cells of rats exposed to strong stress effects, e.g., suspension for 2.5 hours a day for 6 days, decreased. The rat studies onboard biosatellites of the Cosmos series have demonstrated that a prolonged exposure to microgravity (up to 22 days) is not a stressogenic factor for the DNA synthetic system of liver cells. The transition from 1 g to microgravity cannot be viewed as a strong stressor either, because the rate of DNA synthesis in liver cells at an early period of adaptation to microgravity remains within the normal limits. However, this parameter decreases significantly during the recovery period following 18 to 22 day flights. Therefore changes in cellular processes related to the DNA replicating function in hepatocytes should be expected to occur in the postflight period rather than at an early period of adaptation to microgravity.

Author

N88-18130# Joint Publications Research Service, Arlington, Va.
RNA-SYNTHESIZING ACTIVITY IN RAT LIVER FOLLOWING FLIGHT ABOARD COSMOS-1667

V. F. MAKEYEVA and G. S. KOMOLOVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 46-49 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 34-36

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The effect of a short-term flight (7 days) on the RNA synthetic activity in isolated nuclei of the rat liver and its content of nucleic acids was investigated. The postflight activity of RNA-polymerase, the key enzyme of RNA synthesis, increased. The endogenous

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synthesis of RNA in nuclei grew, probably due to the change in the activity of the RNA-polymerase. Conversely, the concentration of nuclei acids in the liver tended to decrease. The results obtained give evidence that the changes in the RNA synthetic apparatus of hepatocytes in short-term flights are similar in sign to those seen in long-term flights. Author

N88-18140# Joint Publications Research Service, Arlington, Va. **SHORT- AND LONG-TERM EFFECTS OF NONLETHAL LEVELS OF FAST HIGH-ENERGY HELIUM IONS ON RETENTION OF DEVELOPED AND FORMATION OF NEW BEHAVIORAL PATTERNS IN RATS**

N. YA. SAVCHENKO *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 105-108 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 70-72 Avail: NTIS HC A08/MF A01

The effect of fast helium ions with an energy of 4 GeV/nucleon was investigated. Rats were used to study the retention of developed behavioral skills and formations of new ones following nonlethal exposure in a changing situation with increased sensory input. It was shown that investigations of rat behavior in a complicated maze is an integral parameter that yields rather complete information about the function of the Central Nervous System (CNS). Worsening of reflex activity was demonstrated 6 and 24 hours after irradiation (manifested by an increase in number of mistakes, prolongation of mean latency period, and increased locomotor response time). A decrease in number of mistakes, latency period, and locomotor response time was observed 5 to 7 days after irradiation. Restoration of some CNS functions, which occurred in the first week, was indicative of developing of compensatory processes. B.G.

N88-18141# Joint Publications Research Service, Arlington, Va. **MYOSIN CA SUP (2+), MG SUP (2+)-ADENOSINE TRIPHOSPHATASE ACTIVITY IN RAY MYOCARDIUM FOLLOWING 30-DAY EXPOSE TO 1.1 AND 2.0 G**

I. B. KRASNOV and YE. A. NOSOVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 109-112 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21 p 72-74 Avail: NTIS HC A08/MF A01

The decline in myosin Ca(2+), Mg(2+)-ATPase in the myocardium of rats flown in space for 18.5 to 22 days aboard Cosmos series biosatellites is viewed as the consequence of absence of sufficient load on the muscular system of the heart in weightlessness, and it is assessed as one of the manifestations of the heart in weightlessness, and it is assessed as one of the manifestations of mammalian adaptation to this state. Data concerning the level of activity of myosin Ca(2+), Mg(2+)-ATPase in the myocardium of rats exposed to both hypergravity (HG) produced during rotation on a centrifuge and relatively reduced gravity (RRG) would be of considerable interest with respect to broadening the ideas about the possibility of adaptation of mammals to altered gravity. The RRG is viewed as a state that arises as a result of reduction in weight (but not mass) of an organism following change from hypergravity, to which the body adapted, to earth's gravity. The RRG state apparently lasts until there is adaptation to earth's gravity of receptor structures that perceive changes in gravity, as well as structures of the nervous and endocrine systems that form the body's response to change in gravity. It can be assumed the changes arising in weightlessness and RRG in structures and systems that perceive change in gravity and effect adaptation to this change will be in the same direction. The objective was to examine the activity of myosin Ca(2+), Mg(2+)-ATPase in the myocardium of rats submitted for 30 days of HG to 1.1 and 2.0 G, as well as RRG for 2 days after discontinuing exposure to the above level of gravity for 30 days. Author

N88-18142# Joint Publications Research Service, Arlington, Va. **KINETIC TOXIC ASPECT OF POTENTIAL USE OF SULFUR HEXAFLUORIDE IN CLOSED ENVIRONMENTS**

S. S. PASHIN, V. F. USHAKOV, A. I. GORSHUNOVA, N. YE OSTASHEVA, YE. B. STADUKHIN, and E. I. CHUKHNO *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 113-119 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 74-77 Avail: NTIS HC A08/MF A01

The effect of sulfur hexafluoride (SF₆ gas) on the body was attributed to its use as an experimental model in the study of the effects of high density gas environments on respiration under hyperbaric conditions. The absence of deaths of experimental animals, even with use of maximum possible concentrations and long exposure time, led to the conclusion that pure SF₆ is nontoxic. Single exposure to SF₆ gas in concentrations of 1500 and 300 g/cu m led to the decline of function parameters of the central nervous system (CNS) of experimental animals. With chronic exposure in concentrations of 77 and 9.8 g/cm in addition to the effect of the CNS, there was a decline in renal function and an insignificant response of parameters of peripheral blood. Questions related to intake, distribution, and elimination of SF₆ gas which were not covered in literature are covered. B.G.

N88-18144# Joint Publications Research Service, Arlington, Va. **COMPARATIVE EVALUATION OF STRESS RESPONSE OF RATS TO DIFFERENT METHODS OF SIMULATING SOME EFFECTS OF WEIGHTLESSNESS**

G. N. DURNOVA, YE. V. VOROTNIKOVA, and N. G. PRODAN *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 123-126 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 79-81 Avail: NTIS HC A08/MF A01

When simulating some of the effects of weightlessness by means of restricting movements or suspension, rats present an acute stress response, the severity and duration of which vary appreciably, depending on the chosen model of weightlessness. A comparative evaluation was made of the stress reaction, using morphological methods, to the most widely used methods of simulating weightlessness, and the nature and severity of this response was judged according to the changes in the adrenals and lymphoid organs that depend on them. Author

N88-18148*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla. **SPECIES BIOLOGY AND POTENTIAL FOR CONTROLLING FOUR EXOTIC PLANTS (AMMOPHILA ARENARIA, CARPOBROTUS EDULIS, CORTADERIA JUBATA AND GASOUL CRYSTALLINUM) ON VANDENBERG AIR FORCE BASE, CALIFORNIA**

PAUL A. SCHMALZER and C. ROSS HINKLE (Bionetics Corp., Cocoa Beach, Fla.) Oct. 1987 103 p (Contract NAS10-10285) (NASA-TM-100980; NAS 1.15:100980) Avail: NTIS HC A06/MF A01 CSCL 06C

Invasive exotic plants can displace native flora and modify community and ecosystem structure and function. Ammophila arenaria, Carpobrotus edulis, Cortaderia jubata, and Gasoul crystallinum are invasive plants present on Vandenberg Air Force Base, California, designated for study by the Environmental Task Force because of the perceived threat they represent to the native flora. Each plant's native habitat, how they came to be at Vandenberg, their propagation, and how they can be controlled is discussed. Author

N88-18149# Health Effects Research Lab., Research Triangle Park, N. C.

EXPERIMENTAL MEASUREMENTS OF THE UPTAKE OF OZONE IN RATS AND HUMAN SUBJECTS

T. R. GERRITY and M. J. WIESTER Oct. 1987 16 p
(PB88-125422; EPA/600/D-87/319) Avail: NTIS HC A03/MF A01 CSCL 06A

Experimental determination of ozone (O₃) uptake in the conducting airways and lungs is a fundamental starting point for interspecies comparisons of delivered dose. Fractional O₃ uptake was measured in the respiratory tract of awake Fischer 344 rats and in the lungs and nasopharynx of young healthy male humans. Awake animals were individually evaluated during nose only exposures to 0.3 ppm O₃ for O₃ removal, O₂ consumption, CO₂ production, and tidal breathing while inside a body plethysmograph. Utilizing these values of O₃ uptake and measures of ventilation, the mass dose rate of O₃ per unit respiratory tract surface area was computed and found to be similar between rats and humans for the same ambient O₃ concentration. GRA

N88-18150# Joint Publications Research Service, Arlington, Va.
JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 21, NO. 6, NOVEMBER - DECEMBER 1987

O. G. GAZENKO, ed. 11 Mar. 1988 149 p Transl. into ENGLISH of *Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina* (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 95 p (JPRS-USB-88-004) Avail: NTIS HC A07/MF A01

Topics addressed include: aerospace medicine; electrocardiography; human tolerance to acceleration; effects of weightlessness on rats; effect of oxygen inhalation on respiratory function; cardiorespiratory parameters; hemodynamics; and space flight stress.

N88-18154# Joint Publications Research Service, Arlington, Va.
EFFECT OF SPACEFLIGHT FACTORS ON BIOLOGICAL MATERIAL FLOWN ABOARD COSMOS-1514 BIOSATELLITE

Y. GAUBIN, M. DELPOUX, J. BIONOV, H. PLANEL, G. GASSET, B. PIANEZZI, M. BURG, and A. BARBAST In its JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 23 11 Mar. 1988 Transl. into ENGLISH from *Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina* (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 18-24

Avail: NTIS HC A07/MF A01

The effect of space flight factors, particularly radiation, on *Artemia salina* cysts, tobacco and rice seeds (embryos and caryopses) was investigated. *Artemia salina* cysts showed no significant deviation in response to this exposure. Minor changes in certain cyst groups were related to their packing, humidity, and preirradiation level. Tobacco seeds exhibited a higher frequency of somatic and morphological changes that were independent of their packing arrangement. Rice seeds developed no changes that could be associated with space flight effects. The changes seen are considered in relation to the radiation dose absorbed. The results obtained in different space experiments are discussed.

Author

N88-18155# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF GENETIC STRUCTURES OF RAT GERM CELLS FOLLOWING FLIGHT ABOARD COSMOS-1514 BIOSATELLITE DURING THEIR PRENATAL DEVELOPMENT

D. K. BENOVA In its JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 32-36 11 Mar. 1988 Transl. into ENGLISH from *Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina* (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 24-27

Avail: NTIS HC A07/MF A01

Male rats that were flown on Cosmos-1514 during their prenatal days 13 through 18 were investigated. The animals were sacrificed when they reached sexual maturity. Preparations were made of their testes for cytogenetic analysis: spermatocytes were at the stages of diakinesis-metaphase 1. The flown rates had 0.9 percent

translocations while the ground-based synchronous controls showed 0.5 percent. Exposure to space flight factors in combination had a mutagenic effect on gonocytes. However, the adverse effect of microgravity per se was not demonstrated unambiguously.

Author

N88-18156# Joint Publications Research Service, Arlington, Va.
MORPHOLOGICAL AND FUNCTIONAL STATE OF THE HYPOTHALAMO-HYPOPHYSEAL NEUROSECRETORY SYSTEM OF RATS FLOWN ABOARD COSMOS-1667

YE. I. ALEKSEYEV In its JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 37-42 11 Mar. 1988 Transl. into ENGLISH from *Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina* (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 27-31

Avail: NTIS HC A07/MF A01

Morphological and morphometric data were used for comparative analysis of changes in the major compartments of the hypothalamic-pituitary neurosecretory system of Cosmos-1667 experimental and control rats. The flown rats showed morphological signs of inhibited ADH production. This inhibition may facilitate fluid excretion and development of a new hydration level at an early stage of adaptation to microgravity. The enhanced ADH secretion from neurons of supraoptic nuclei of the hypothalamus and axons of the posterior pituitary may lead to water retention and compensation of water loss after return to Earth's gravity.

Author

N88-18157# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF RAT SKELETAL MUSCLES FOLLOWING SHORT-TERM SPACEFLIGHT ABOARD COSMOS-1667 BIOSATELLITE

YE. I. ILYINAKAKUYEVA In its JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 43-49 11 Mar. 1988 Transl. into ENGLISH from *Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina* (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 31-35

Avail: NTIS HC A07/MF A01

Using morphological and histochemical methods, skeletal muscles (soleus, gastrocnemius, quadriceps, and biceps) of Wistar-SPF rats flown for 7 days on Cosmos-1667 were investigated. The short-term exposure to microgravity led to muscle atrophy which primarily involved myofibers with a high level of oxidative metabolism and a low level of ATPase activity. The percentage composition of myofibers of different types remained unchanged. The soleus muscle showed the greatest changes which included both atrophic and dystrophic shifts. Muscle atrophy developed together with metabolic changes that resulted in glycogen accumulation and decreased SDH activity. After return to Earth's gravity microcirculation disorders were seen only in the soleus muscles.

Author

N88-18158# Joint Publications Research Service, Arlington, Va.
MORPHOLOGICAL STUDY OF EARLY CHANGES IN RAT BONES IN SIMULATED WEIGHTLESSNESS

A. S. KAPLANSKIY, Z. F. SAKHAROVA, YE. I. ILYINAKAKUYEVA, and G. N. DURNOVA In its JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 50-54 11 Mar. 1988 Transl. into ENGLISH from *Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina* (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 36-39

Avail: NTIS HC A07/MF A01

By histomorphometric methods tibial bones and lumbar vertebrae of rats exposed for 7 days to hypokinesia or head-down suspension were investigated. Both hypokinesia and suspension led to osteoporosis of the tibial metaphyseal spongiosa which was primarily induced by bone growth inhibition and probably by increased bone resorption. No signs of osteoporosis were seen in tibial diaphyses. In contrast to tibial bones, osteoporosis of the spongiosa of lumbar vertebrae was found only in hypokinetic rats. It is concluded that exposure to simulated microgravity early signs of osteoporosis occur in the tibial spongiosa and that changes in

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the spongy matter of tubular bones and vertebrae are similar and systemic. It is suggested that an acute stress-reaction in response to simulated microgravity plays a certain role in the development of osteoporosis. Author

N88-18159# Joint Publications Research Service, Arlington, Va.
LIPID PEROXIDATION IN RAT TISSUES WITH EXPOSURE TO ANTIORTHOSTATIC HYPOKINESIA, EXERCISE AND IMMOBILIZATION STRESS

A. YE. ZEZEROV, S. M. IVANOVA, and A. S. USHAKOV *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 55-61 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 39-43
 Avail: NTIS HC A07/MF A01

Lipid peroxidation in tissues of rats exposed to antiorthostatic hypokinesia (-15 deg) for 60 days, heavy-load exercise (swimming), and 2-hour immobilization was investigated polarographically. Antiorthostatic hypokinesia produced activation of free-radical lipid peroxidation in skeletal muscles, myocardium, and plasma which reached a peak on hypokinesia day 3 and remained elevated by day 60. Exercise and immobilization applied during hypokinesia led to an accumulation of endogenous lipid peroxidation products in skeletal muscles and in the heart, although in a lesser degree. It is postulated that during hypokinesia lipid peroxidation is most probably activated due to the following factors: increased activity of the hormonal component of the sympathoadrenal system, accumulation of excessive quantities of free fatty acids, and reduced activity of antioxidant enzymes. Author

N88-18160# Joint Publications Research Service, Arlington, Va.
ROLE OF CARBON DIOXIDE IN CORRECTION OF COAGULATION HEMOSTASIS UNDER HYPOXIC CONDITIONS

G. D. PAK and V. S. SVERSHKOVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 62-67 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 43-47
 Avail: NTIS HC A07/MF A01

In acute animal experiments coagulation hemostasis reactions and blood acid-base state were investigated when dogs were breathin hypoxis (10 percent O₂) or hypoxic-hypercapnic (10 percent O₂, 5 percent CO₂) gas mixtures. When given the hypoxic mixture, activation of blood coagulation was accompanied by depression of anticoagulatory and fibrinolytic properties. These changes developed together with distinct hypoxemia, respiratory alkalosis, and secondary metabolic acidosis. When given the hypoxic-hypercapnic mixture, no hypercoagulation occurred which can be explained by higher (than on the hypoxic mixture) p sub a O₂, lack of disorders in acid-base equilibrium, and in oxygen supply. It is believed that the ability of carbon dioxide to maintain relative normocoagulation when added to the hypoxic mixture is one of the factors that increase tolerance to hypoxia. Author

N88-18161# Joint Publications Research Service, Arlington, Va.
EFFECT OF CARDIOACTIVE COMPOUNDS ON RAT MYOCARDIUM ACTOMYOSIN FOLLOWING EXPOSURE TO ACCELERATIONS

M. A. KAYFADZHYAN and B. A. TIKUNOV *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 68-72 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6 Nov. - Dec. 1987 p 47-49
 Avail: NTIS HC A07/MF A01

It was shown that during centrifugation the modulating effect of cardioactive compounds, particularly adrenalin and obsidan, varies in similarity to that of Ca ions. The reactivity of the native actomyosin complex of the heart of white rats to such agents declines during centrifugation. This may be associated with changes in regulatory protein components through which the modulating

effect of the above compounds is mediated. Differences in the reactivity to adrenalin and obsidan that persist after 2-month readaptation can be attributed to the heterogeneous recovery of properties of individual subunits of regulatory proteins. Author

N88-18162# Joint Publications Research Service, Arlington, Va.
MORPHOLOGICAL MANIFESTATIONS OF PRIMATE ADAPTATION TO ORTHOGRADE STATICS AND WALKING ERECT

G. S. BELKANIYA, YU. N. KUROCHKIN, A. S. RAKHMANOV, K. V. SIMAVONYAN, V. A. DARTSMELIYA, A. N. DEMIN, and V. YE. FILENKO *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 73-78 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 51-54
 Avail: NTIS HC A07/MF A01

Using lower primates (rhesus monkeys) who were experimentally transformed to bipeds, morphological signs of their musculoskeletal adaptation to the upright walking patterns were examined. It was found that the biped developed typical characteristics of the upright posture: complete erectness of the torse and legs and noticeable enhancement of lumbar lordosis. The maximum deviation of the lumbar arch in the bipeds (10.0 + or 0.8 mm) was significantly greater than in the controls (1.5 + or - 0.5 mm). This was accompanied by distinct hypertrophy of leg muscles, primarily extensors, and increased mineral density of the tibia (by 38 percent), fibule (by 14 percent), and metatarsus by 23 percent). This was also followed by slight hypotrophy of biceps and triceps muscles and the large muscle of the thorax. Forearm muscles and bone mineral content were unchanged. The data obtained gave evidence that the genetic program of orthograde statics and erect posture which is typical of the entire primate order can find phenotypical realization in lower primates. Author

N88-18166# Joint Publications Research Service, Arlington, Va.
EFFECT OF EXTERNAL ELECTROSTATIC FIELD ON CATECHOLAMINE SECRETION BY RAT ADRENALS

G. G. ARTSRUNI, A. V. ZILFYAN, N. R. AZGALDYAN, and R. A. DOVLATYAN *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 99-103 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 67-70
 Avail: NTIS HC A07/MF A01

Experimental rats were exposed to an electrostatic field of 200 kW/m for 1, 24, or 6 hours a day for 6 days. The effect of this exposure on the structure and function of adrenal chromaffin bodies and the concentration of catecholamines and their precursors in blood and adrenals was investigated. Using histochemical fluorescent microscopic and spectrofluorimetric methods, it was found that the exposure may modify the structure and function of adrenal chromaffins and the concentration of catecholamines in blood and adrenals. These changes depended on the exposure time. An hour exposure activated the secretory apparatus of adrenal chromaffins and enhanced catecholamine secretion to blood. A 24-hour exposure led to an increase in the concentration of catecholamines in adrenals and blood and a change in the organ cytoangioarchitectonics. A 6 day fractionated exposure resulted in a decrease of catecholamines both in blood and adrenals. Author

N88-18173# Oak Ridge National Lab., Tenn.
SCALING PHYSIOLOGICAL PHARMACOKINETIC MODELS BY PHYSIOLOGICAL TIME

R. C. WARD and C. C. TRAVIS 1987 10 p Presented at the Society for Computer Simulation Multiconference, San Diego, Calif., 3 Feb. 1988
 (Contract DE-AC05-84OR-21400)
 (DE88-000335; CONF-880218-1) Avail: NTIS HC A02/MF A01

This paper shows that a multicompartiment physiological pharmacokinetic model, used to account for inhalation exposure

AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A88-25255

EFFECTS OF WATER IMMERSION ON ARGININE VASOPRESSIN RELEASE IN HUMANS

PETER NORSK and MURRAY EPSTEIN (USVA, Medical Center, Miami, FL) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, Jan. 1988, p. 1-10. refs

Current knowledge regarding the effects of water immersion (WI) on arginine vasopressin (AVP) release in normal humans is reviewed. It is concluded that WI constitutes a unique investigative tool for assessing the interaction of AVP and renal water handling during manned spaceflight. Theoretical considerations suggest that a redistribution of blood volume induced by the zero-gravity state with a consequent relative central hypervolemia may induce an increase in renal water and electrolyte excretion. Since WI induces such changes as facial puffiness and decreases in the circumference of the lower extremities, this model has been proposed as a relevant technique for simulating aspects of human exposure to weightlessness. K.K.

A88-25437

CARDIOVASCULAR RISK SCREENING IN AVIATORS

DANIEL S. BERLINER (Lovelace Medical Center, Albuquerque, NM), FRANK S. PETTYJOHN (U.S. Army, Medical Dept., Fort Stewart, GA), and WILLIAM J. OETGEN (Walter Reed Army Medical Center, Washington, DC) *Aviation Medicine Quarterly* (ISSN 0951-3949), vol. 1, March 1987, p. 3-8. refs

In this paper, the ability of the Framingham Risk Index (FRI) to predict cardiovascular risk in aviators was investigated. Fourteen pilots (mean age 45 yrs) were evaluated by complete medical history, physical examination, laboratory analyses, chest X-ray, and resting ECG, followed by graded maximal treadmill exercise tolerance test (GXT). One pilot had a positive GXT, which was definitely associated with the history of tobacco use and the elevated concentrations of serum cholesterol and triglycerides. In the five cases with borderline GXT results, the only significant positive correlation was tobacco use, while the normal GXT cases could not be correlated either positively or negatively with the above parameters. The FRI, calculated for the entire group, was 3.4 percent, with a range from 0.3 to 11.4 percent. Using the FRI value of 5 percent as the lower limit of abnormality, and performing the GXT test, the sensitivity of the FRI as a test for abnormal GXT was found to be 100 percent. I.S.

A88-25438

CIRCADIAN RHYTHMS AND AVIATION

D. S. MINORS and J. M. WATERHOUSE (Manchester, Victoria University, England) *Aviation Medicine Quarterly* (ISSN 0951-3949), vol. 1, March 1987, p. 9-26. refs

The basic properties of the internal clock and the consequences to the performance and wellbeing of aircrew, travelers, and night workers resulting from the disturbance of the interaction between the internal clock and the rhythmicity of external environment are discussed. The temporary mismatching between the internal clock and the environmental rhythmicity is believed to account for the general malaise experienced after time-zone transitions and during night work; for aircrew, a combination of duty schedules and time-zone transitions that produces irregular hours of sleep and wakefulness will result in loss of sleep that will exacerbate decrements in performance due to the trough of circadian rhythmicity. Various methods for combatting the undesirable side-effects of rhythm desynchronization are suggested. I.S.

to volatile chlorohydrocarbons in mammalian species, can be made species-independent if chronological time is re-expressed in terms of physiological time. Physiological time is defined as chronological time divided by species body weight to the 1/4 power. We demonstrate the usefulness of this time scaling of the multicompartiment physiological pharmacokinetic model by using it to model the inhalation of the volatile chlorinated hydrocarbon tetrachloroethylene in mice, rats, and humans. DOE

N88-18174*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

NASA WORKSHOP ON BIOLOGICAL ADAPTATION

EMILY MOREY-HOLTON, ed. and MARC TISCHLER, ed. (Arizona Univ., Tucson.) Feb. 1988 105 p Workshop held 28-30 Apr. 1986

(NASA-TM-89468; A-87248; NAS 1.15:89468) Avail: NTIS HC A06/MF A01 CSCL 06B

A workshop was convened to review the current program in Space Biology Biological Adaptation Research and its objectives and to identify future research directions. Two research areas emerged from these deliberations: gravitational effects on structures and biomineralization and gravity affected regulatory mechanisms. The participants also recommended that research concentrate on rapidly growing animals, since gravity effects may be more pronounced during growth and development. Both research areas were defined and future research directions were identified. The recommendations of the workshop will assist the Life Sciences Division of NASA in its assessment and long-range planning of these areas of space biology. Equally important, the workshop was intended to stimulate thought and research among those attending so that they would, in turn, interest, excite, and involve other members of the academic community in research efforts relevant to these programs. Author

N88-18175*# Lockheed Engineering and Management Services Co., Inc., Washington, D.C.

USSR SPACE LIFE SCIENCES DIGEST, ISSUE 15

LYDIA RAZRAN HOOKE, ed., RONALD TEETER, ed., VICTORIA GARSHNEK, ed., and JOSEPH ROWE, ed. (Library of Congress, Washington, D. C.) Mar. 1988 120 p

(Contract NASW-4292)
(NASA-CR-3922(18); NAS 1.26:3922(18)) Avail: NTIS HC A06/MF A01 CSCL 06B

This is the 15th issue of NASA's USSR Space Life Sciences Digest. It contains abstracts of 59 papers published in Russian language periodicals or presented at conferences and of two new Soviet monographs. Selected abstracts are illustrated with figures and tables from the original. An additional feature is a review of a conference devoted to the physiology of extreme states. The abstracts included in this issue have been identified as relevant to 29 areas of space biology and medicine. These areas are adaptation, biological rhythms, biospherics, body fluids, botany, cardiovascular and respiratory systems, endocrinology, enzymology, equipment and instrumentation, exobiology, genetics, habitability and environment effects, human performance, immunology, life support systems, mathematical modeling, metabolism, microbiology, musculoskeletal system, neurophysiology, nutrition, operational medicine, perception, personnel selection, psychology, radiobiology, reproductive biology, and space biology and medicine. Author

A88-25440**AEROMEDICAL EVACUATION**

C. A. B. MCLAREN Aviation Medicine Quarterly (ISSN 0951-3949), vol. 1, March 1987, p. 41-49. refs

The following six most important factors that should be considered in setting up aeromedical service are discussed: the patient, the aircraft, communications, the aeromedical team, the equipment, and the training. In relation to the patient factor it is noted that, in the military environment, the only two groups of patients who should not be transported in any case are those already moribund and, in case of satisfactory local facilities, patients who have suffered massive coronary infarction. Special attention should be given to the maintenance of the ambient cabin pressure, since low pressures affect the oxygen transport system. Communications have been shown to be the most important part of the aeromedical evacuation; the best staff and equipment are useless if the wrong information is obtained from the overseas medical staff. I.S.

A88-25441**MUST INTERNATIONAL AIRCREW MEDICAL REQUIREMENTS BE INCOMPATIBLE?**

R. GRAEME CAMERON Aviation Medicine Quarterly (ISSN 0951-3949), vol. 1, March 1987, p. 51-58.

The medical requirements for the ICAO Class 1 (which includes the categories of the commercial pilot, senior commercial pilot, airline transport pilot, flight navigator, and flight engineer) and the Class 2 (including the categories of private pilot, glider pilot, free balloon pilot, and flight radio operator) aircrew licences are discussed, and the ICAO standards are compared with those of six countries. The standards are quoted, according to the class, for Australia, Canada, New Zealand, UK, USA, and Switzerland, and the variations in the standards are pointed out. The data demonstrate the confusion which exists, particularly concerning airline transport pilots. In particular, the six countries have six different requirements concerning the periodicity of general examinations, only one of the requirements coinciding with the ICAO standard. Because of the increased tendency of flight crews to take employment in countries other than that of their initial licensing, the importance of international standards is emphasized. I.S.

A88-25442**INDIVIDUALIZATION OF PILOT MEDICAL CERTIFICATION - THE AVIATION MEDICAL EXAMINER'S ROLE**

STANLEY R. MOHLER (Wright State University, Dayton, OH) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 1, March 1987, p. 59-65. refs

The past and current medical U.S. standards for civil pilot licensing are discussed, together with the issue of the individualization of medical certification. Today, the question addressed by the medical examiner is not simply whether or not a specific individual meets the published medical standards. Rather, the current health status of the individual is assessed in relation to his reasonably safe piloting capabilities within the specific flight environment. Special attention is given to the question of special issuances to pilots returning to duty after having experienced an incidence of alcoholism, coronary artery surgery, myocardial infarction, a neurological condition, a psychiatric illness, or cancer. Data on return-to-duty of such pilots reflect the increasing modernization of the U.S. civil aviation medicine program. I.S.

A88-25443**ATRIAL FIBRILLATION IN AIRCREW - AEROMEDICAL RISK**

DANIEL S. BERLINER (U.S. Army, Medical Research and Development Command, Frederick, MD), MICHAEL G. LILIENTHAL (U.S. Navy, Aerospace Medicine Research Laboratory, Pensacola, FL), and FRANK S. PETTYJOHN Aviation Medicine Quarterly (ISSN 0951-3949), vol. 1, March 1987, p. 67-72. refs

Atrial fibrillation (AF), either paroxysmal or chronic, has long been classified as a condition incompatible with flying duties. However, a single episode of AF in an aircrew member poses a diagnostic challenge in terms of aetiology and long term prognosis.

Thirty-five cases of documented AF in U.S. Army aircrew members are reviewed. While the incidence of this condition in the flying population remains low (0.01-0.02 percent), a suggested approach to these aircrew members includes an extensive cardiovascular examination fully to define risk. The fact that 66 percent of these individuals were returned to full aviation duties without use of medication and without risk to the individual or to aviation safety is considered a significant saving. Further cardiovascular study defining AF and drug effects could return 80 percent to full flying duty. Author

A88-25526**THE EFFECT OF RELATIVISTIC CHARGED PARTICLES ON THE FREQUENCY OF CHROMOSOME ABERRATIONS IN HUMAN BLOOD LYMPHOCYTES - THE DOSE-RESPONSE AND RBE OF PROTONS, DEUTERONS, AND HELIUM IONS [VLIANIE ZARIAZHENNYKH CHASTITS RELATIVISTSKIKH ENERGII NA CHASTOTU KHROMOSOMNYKH ABERRATSII V LIMFOTSITAKH KROVI CHELOVEKA: ZAVISIMOST' DOZA-EFFEKT I OBE PROTONOV, DEITONOV I IONOV GELIIA]**

V. N. GERASIMENKO, A. I. PORTMAN, M. BULANOVA, B. IVANOV, and M. MILEVA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) Radiobiologiya (ISSN 0033-8192), vol. 27, Nov.-Dec. 1987, p. 743-747. In Russian. refs

A88-25713**SPACE MEDICINE**

PAUL C. RAMBAUT (NIH, Bethesda, MD) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 1, no. 2, 1987, p. 85-92. refs

The changes occurring in the adult human in space as a result of weightlessness and radiation are reviewed. Therapeutic procedures to ward off the more hazardous effects of prolonged space flight are described. The vestibular changes experienced during weightlessness, though irksome and potentially dangerous, are transient. Reduction in the circulating blood volume can be temporarily replenished or counteracted during the critical reentry phase. Bone and muscle deterioration seems manageable through physical exercise, compression, and electrostimulation. Of all the hazards that must be dealt with in space none appears more challenging than that of radiation. The longer man spends in space and the further he ventures from the relatively safe confines of LEO, the more this factor will impede his progress unless suitable preventive measures can be devised. Author

A88-25714**NOISE HAZARD FOR CREWS OF LIGHT AIRCRAFT**

C. C. HARLING (Northern General Hospital, Sheffield, England) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 1, no. 2, 1987, p. 93-99. refs

Measurements of the noise levels in four Cessna 152 aircraft were performed during various phases of flight. Noise levels, which varied with engine speed rather than airspeed, were found with a mean of 95.5 dB(A) during the take-off run, 93 dB(A) during climb out, and between 89 and 92 dB(A) during cruise. During the descent, noise levels were lower with a mean of 87 dB(A) during powered approach and 79 dB(A) during glide descent. The study suggests that private flying is not in itself likely to be a significant cause of noise-induced hearing loss, but in a number of private flights with other noise exposure, it may be a significant factor. K.K.

A88-25715**SHORT PR INTERVAL-NORMAL QRS AND AEROMEDICAL IMPLICATIONS**

FRANK S. PETTYJOHN and DANIEL S. BERLINER (Lovelace Medical Center, Albuquerque, NM) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 1, no. 2, 1987, p. 101-104. refs

The review by Lown et al. (1953) of EKG findings of a short PR interval with a normal QRS duration called attention to the nearly 6-fold increased incidence of tachyarrhythmias in affected individuals. This has resulted in military aviation medicine standards that exclude those with EKG evidence of a short PR and normal

QRS from entering into flight training programs. Analysis of data from the waiver and review files of the U.S. Army Aeromedical Center revealed 26 aviators and 5 air traffic controllers with the described EKG findings who had entered training prior to the identification of this syndrome. Follow-up of the aviator group revealed no losses due to arrhythmias. Discussion of the potential for reentrant tachyarrhythmias points to the need for continued follow-up of the individual with a short PR involved in aviation-related duties. Author

A88-25717

FLIGHT MEDICALS - A COMMON CAUSE OF 'REACTIVE HYPERTENSION' IN PILOTS

JOEL M. NEUTEL, HAROLD BERNITZ, CLIVE SINDELMAN, and DIRK P. MYBURGH (Institute of Aviation Medicine, Verwoerdburg, Republic of South Africa) *Aviation Medicine Quarterly* (ISSN 0951-3949), vol. 1, no. 2, 1987, p. 117-124. refs

A comparison was made between blood pressure (BP) readings obtained by an ambulatory BP system in the absence of a doctor and those readings obtained in the presence of a doctor in a group of allegedly hypertensive pilots during their annual flight medical examination. Fifty pilots with a systolic BP of greater than 145 mmHg and/or diastolic BP of greater than 95 mmHg were selected. Through the use of an ambulatory BP system, it was found that 96 percent of these pilots normalized their BPs in the absence of a doctor. This group included four pilots already on hypotensive agents. K.K.

A88-26015

THE ENTROPY-STATISTICAL, SPECTRAL, CONDITIONAL-PROBABILISTIC, AND DETERMINATE CHARACTERISTICS OF HEART RHYTHM FOR DIFFERENT FUNCTIONAL STATES OF THE HUMAN ORGANISM [ENTROPIINO-STATISTICHESKIE, SPEKTRAL'NYE, USLOVNO-VEROIATNOSTNYE I DETERMINIROVANNYE KHARAKTERISTIKI SERDECHNOGO RITMA V RAZLICHNYKH FUNKTSIONAL'NYKH SOSTOIANIIAKH CHELOVEKA]

A. M. ZINGERMAN, M. A. KONSTANTINOV, V. S. LOGVINOV, D. N. MENITSKII, and E. G. VASHCHILLO (AMN SSSR, Nauchno-Issledovatel'skii Institut Eksperimental'noi Meditsiny, Leningrad, USSR) *Uspekhi Fiziologicheskikh Nauk* (ISSN 0301-1798), vol. 19, Jan.-Mar. 1988, p. 40-55. In Russian. refs

A88-26066

DYNAMICS OF THE TOPOGRAMS OF THE CORTEX POTENTIALS IN THE LARGE CEREBRAL HEMISPHERES OF HUMANS DURING ACTIVE SELF-REGULATION OF THEIR CONDITIONS [DINAMIKA TOPOGRAMM POTENTIALOV KORY BOL'SHIKH POLUSHARII MOZGA CHELOVEKA PRI AKTIVNOI SAMOREGULIATSII SOSTOIANII]

I. N. KNIPST, A. V. KORINEVSKII, N. S. KUROVA, and A. P. RAGULIN (AN SSSR, Institut Vysshei Nervnoi Deiatel'nosti i Neirofiziologii, Moscow, USSR) *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 13, Nov.-Dec. 1987, p. 919-925. In Russian. refs

A88-26067

DETERMINATION OF THE SOURCES OF THE MAGNETIC ALPHA-RHYTHM IN HUMANS [OPREDELENIE ISTOCHNIKOV MAGNITNOGO AL'FA-RITMA CHELOVEKA]

V. L. VVEDENSKII, K. G. GURTOVOI (AN SSSR, Institut Atomnoi Energii, Moscow, USSR), R. ILMONIEMI, and M. J. KAJOLA (Helsinki University of Technology, Espoo, Finland) *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 13, Nov.-Dec. 1987, p. 934-939. In Russian. refs

The character of the sources of magnetic alpha-rhythms in the human brain cortex and the distribution of these sources were investigated using a four-channel neuromagnetometer for recording cortical magnetolectric signals of two resting subjects. The magnetoencephalograms from all four channels displayed series of spindlelike patterns characterized by rises (from zero) and falls of the signal amplitudes and by stable oscillation periods of about 100 msec. These high-amplitude alpha-rhythm spindles

corresponded to magnetic-field sources located in one of the furrows of the parieto-occipital zone. The position of a magnetic-field source related to a spindle was constant; however, different spindles could be induced by different sources, including those located in different hemispheres. I.S.

A88-26068

STATISTICAL ANALYSES OF HEART RHYTHM CONTROL CHARACTERISTICS [STATISTICHESKIE ISSLEDOVANIYA POKAZATELEI REGULIATSII SERDECHNOGO RITMA]

M. E. LIVSHITS (Leningradskii Elektrotekhnicheskii Institut, Leningrad, USSR) *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 13, Nov.-Dec. 1987, p. 965-970. In Russian. refs

A new characteristic index for analyzing the state of cardiac activity was developed. This index, termed 'heart-rhythm strain', describes the status of the cardiac regulatory activity more reliably than the previously used parameters; i.e., the vegetative rhythm index and the index of stress. The HRS index was developed on the basis of animal studies by Azhipa (1970), in which the responses of heart rhythm to electrostimulation of emotogenic brain structures were measured. The most important advantage of the HRS index over the previously used characteristics is the possibility it offers for assessing the day-to-day changes in the cardiac activity by comparing the HRS values with the known maximal (HRS = 140, during acute stages of such traumas as myocardial infarct) and minimal (HRS = 0.12) values of the index, making it possible to predict the likelihood of oncoming physical distress. I.S.

A88-26069

EVOKED POTENTIALS, PERCEPTION, AND CYCLIC PROCESSES [VYZVANNYE POTENTIALY, VOSPRIYATIE I TSIKLICHESKIE PROTSESSY]

L. I. PERESLENI, M. B. MIKHALEVSKAIA, and A. N. GUSEV (Akademiya Pedagogicheskikh Nauk, Nauchno-Issledovatel'skii Institut Defektologii; Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) *Fiziologiya Cheloveka* (ISSN 0131-1646), vol. 13, Nov.-Dec. 1987, p. 1015-1022. In Russian. refs

The interrelationships between perception and the amplitude-temporal parameters of evoked potentials (EPs) at different levels of stimulus uncertainty were investigated. The EPs were determined in subjects who were asked to differentiate between two types of sound stimuli: (1) a standard of white noise (100 msec of 60 dB) and (2) a mixture of white noise and a tone of 1000 Hz. The two stimuli were presented in random order in blocks of 200-400 samples, with the stimulus probability being 0.1, 0.3, 0.5, or 0.9 in different series. For each block, the number of omissions, the probability of correct detection, the mean EP for both stimuli, and the EP dispersion were computed. The data were interpreted in the framework of Bernshtein's (1947) model, in which cognitive operations are realized by means of cyclic processes in which the detection, recognition, and decision making are realized on different phases of information processing depending on previous experience. I.S.

A88-26144

EFFECT OF +GZ ACCELERATIONS ON VERTEBRAL PAINS

MIECZYSLAW WOJTKOWIAK and JOZEF DOMASZUK (Wojakowski Instytut Medycyny Lotniczej, Warsaw, Poland) *Postepy Astronautyki* (ISSN 0373-5982), vol. 20, no. 1-2, 1987, p. 37-43. In Polish. refs

The effect of +Gz accelerations on the mechanisms of vertebral pain occurrence in the case of the pilot's sitting position shift is analyzed. The angles between the head and back and the backrest and the pelvis forward shift were taken into consideration. It was shown that the pilot's voluntary position change deteriorates the conditions for +Gz energy absorption and may cause vertebral pains. Author

A88-26145

THE EFFECT OF VITAMIN AND MINERAL SUPPLEMENTS ON THE ENHANCEMENT OF HUMAN PHYSICAL WORK CAPACITY [WPŁYW KOREKTORÓW ŻYWIENIOWYCH NA ZDOLNOŚĆ ADAPTACYJNĄ CZŁOWIEKA DO WYSILKU]

HENRYK MALEWICZ (Wojskowy Instytut Medycyny Lotniczej, Warsaw, Poland) Postepy Astronautyki (ISSN 0373-5982), vol. 20, no. 1-2, 1987, p. 45-64. In Polish. refs

The functions of vitamin and mineral supplements are described as well as their applications in enhancing human physical work capacity. The receptors of these supplements contain important chemical substances such as substrates, catalysts, and materials for the regeneration of body fluids and tissues. The use of vitamin and mineral supplements to alleviate stress is discussed. K.K.

A88-26713

ACCELERATION-INDUCED ELECTROCARDIOGRAPHIC INTERVAL CHANGES

CYRUS C. WHINNERY (U.S. Air Force Academy, Colorado Springs, CO) and JAMES E. WHINNERY (USAF, Acceleration Effects Laboratory, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Feb. 1988, p. 102-106. refs

The effect of acceleration on the electrocardiographic intervals PR, QRS, QT, and RR was studied in healthy subjects who were undergoing routine exposure to +Gz stress on a training centrifuge. The intervals before, during, and post +Gz stress were measured. While the PR and QRS intervals were found to respond to Gz stress in a predictable manner (i.e., shortening during the stress and returning to baseline values post-stress), the QT interval did not depend solely on the heart rate. During the +Gz stress, the QT was shortened and remained shortened even though the heart rate returned to baseline in the post-stress period. It is suggested that the QT interval variations reflect the effects of both the heart rate and the autonomic balance during and after +Gz stress; thus, it may provide a measure of the prevailing autonomic tone existing at a given point associated with +Gz stress. I.S.

A88-26714

CARDIOVASCULAR RESPONSES TO HEAD-UP TILT AFTER AN ENDURANCE EXERCISE PROGRAM

JAMES A. PAWELCZYK, W. LARRY KENNEY, and PATTI KENNEY (Pennsylvania State University, University Park) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Feb. 1988, p. 107-112. refs

The relationship between aerobic exercise and the maintenance of blood pressure was studied by assessing the cardiovascular responses to 10 min orthostasis before and after an aerobic exercise program. Human subjects exercised for seven weeks, four times per week, 50 min per session at 70 percent of maximal heart rate (HR). Systolic (SBP), diastolic (DBP), and pulse (PP) blood pressures were measured each minute during the orthostasis test (10 min of foot-supported 70-deg head-up tilt, HUT, preceded and followed by 5 min of supine rest). Following the exercise program, the maximal aerobic power was found to increase by 8.7 percent, while the resting values of HR, SBP, and DBP decreased. During HUT after the exercise, HR increased by 7.1 beat/min (as compared to the HUT-induced increase before the exercise program), but SPB decreased (by 3.4 mm Hg), with no differences noted in the changes in DBP, PP, or mean arterial pressure. I.S.

A88-26715

PERFORMANCE-BASED ASSESSMENT OF OCULOMOTOR EFFICIENCY

LYNN C. PERCIVAL and FRED E. GUEDRY, JR. (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Feb. 1988, p. 113-120. Navy-sponsored research. refs

Acquisition of visual information from spatial points disparate enough to necessitate head and eye movement involves the vestibular and other oculomotor control systems in shifting and stabilizing gaze relative to those points. In the present study, a simple procedure to test oculomotor abilities was developed and

evaluated; it uses performance (serial letter identification) to maintain initial gaze position and performance (number of digits correctly identified) to measure the efficiency of gaze-shift control. Number of digits acquired from briefly displayed digit sets was consistently and powerfully influenced by exposure duration of digit sets and to a lesser extent by the size of required gaze shift. The performance of normal subjects in eye movement and head-and-eye movement conditions is predictable from static performance of normals. Results suggest that the procedure will be sensitive to certain types of CNS and vestibular pathology. Substantial individual differences in performance dependent upon gaze-shift control were found among normal subjects. If some pilots operate at the lower extremes of the performance distribution, they may be subject to critical response deficiencies in emergency conditions requiring large gaze shifts. Author

A88-26716

A COMPARISON OF THE DYNAMICS OF HORIZONTAL AND VERTICAL SMOOTH PURSUIT IN NORMAL HUMAN SUBJECTS

R. W. BALOH, R. D. YEE, V. HONRUBIA, and K. JACOBSON (California, University, Los Angeles) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Feb. 1988, p. 121-124. refs

(Contract NIH-NS-09823; NIH-EY-04556; NIH-EY-03737; NIH-NS-09823)

As a part of the study comparing vertical and horizontal visual-vestibular interaction, a direct comparisons were made, for the same subject, between horizontal and vertical smooth pursuit, by recording the eye movements with a scleral contact lens technique of Collewijn et al. (1975) at multiple sinusoidal frequencies (0.2-1.6 Hz) and peak velocities (12.5-100 deg/sec) in 10 normal subjects in seated position. The results show that, except for the lowest frequency and peak velocity, horizontal pursuit was superior to vertical pursuit. Consistent nonlinearities in the gain of both horizontal and vertical pursuit were found over a wide frequency range. For any given frequency, increasing amplitude and, thereby, peak velocity, resulted in a decrease in pursuit gain. I.S.

A88-26718

AUTOLOGOUS RED BLOOD CELL REINFUSION - EFFECTS ON STRESS AND FLUID REGULATORY HORMONES DURING EXERCISE IN THE HEAT

R. P. FRANCESCONI, M. N. SAWKA, R. C. DENNIS, R. R. GONZALEZ, A. J. YOUNG (U.S. Army, Research Institute of Environmental Medicine, Natick; U.S. Navy, Naval Blood Research Laboratory; Boston University, MA) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Feb. 1988, p. 133-137. refs

A88-26719

DARK FOCUS MEASURED IN NAVY JET TACTICAL FIGHTER PILOTS

LEONARD A. TEMME, EDWARD RICKS, and AILENE MORRIS (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Feb. 1988, p. 138-141. Navy-supported research. refs

Visual accommodation was measured with the laser-Badal optometer in 98 U.S. Navy fighter pilots who were in a dark environment without visual stimuli. The average dark focus of the pilots was 0.25 diopters of myopia; 40 percent were either emmetropic or hyperopic in the dark. Only 4 percent had as much dark myopia as 50 percent of a sample of 220 college students. Although the jet fighter pilots, as a population, differed from college students in terms of dark focus, it remains to be determined whether the remarkable dark focus of the pilots was a function of training or selection. The dark focus measurements of the pilots were compared to their mean night carrier landing scores and their mean target detection slant range scores; i.e., the distance at which an adversary aircraft is first sighted during an air combat maneuver training engagement. Neither the night carrier landing

scores nor the target detection slant range scores correlated significantly with dark focus measurements. Author

A88-26721

EFFECT OF LONG-TERM PHYSICAL EXERCISE ON LYMPHOCYTE REACTIVITY - SIMILARITY TO SPACEFLIGHT REACTIONS

F. K. GMEINDER, G. LORENZI, B. BECHLER, P. JOLLER, J. MUELLER (Zuerich, Eidgenoessische Technische Hochschule; Universitaetsspital, Zurich; ANAWA-Laboratories, Wangen, Switzerland) et al. *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, Feb. 1988, p. 146-151. Research supported by the Eidgenoessische Technische Hochschule Zurich. refs
(Contract SNSF-3,382,0,82)

The effect of the sustained physical stress of marathon running on the response of critical immunological parameters was assessed in seven athletes, for whom the responsiveness of lymphocytes (measured as mitogenic response to con A), the numbers of lymphocytes, the lymphocyte subsets, and leukocyte numbers were analyzed before and after the run. After the marathon run, lymphocyte responsiveness was found to be depressed to 1-70 percent of the resting values, even though the lymphocyte counts did not change. Leukocyte counts were elevated 2.8-fold, and, two days after the run, significant increases were found in pan T-cells and the helper/inducer subset, while the numbers of B-cells decreased. In addition, the exercise was found to result in the increases of cortisol (2.1-fold), epinephrine (3.2-fold), and norepinephrine (2.7-fold). These responses to sustained physical stress were strikingly similar to those observed after a spaceflight. I.S.

A88-26722* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECT OF LONGITUDINAL PHYSICAL TRAINING AND WATER IMMERSION ON ORTHOSTATIC TOLERANCE IN MEN

J. E. GREENLEAF, E. R. DUNN, C. NESVIG, L. C. KEIL, M. H. HARRISON (NASA, Ames Research Center, Moffett Field, CA) et al. *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, Feb. 1988, p. 152-159. refs
(Contract NASA TASK 199-21-12-07)

The effect of six months of moderately intense aerobic training on 60-deg head-up tilt tolerance was assessed before and after 6 hrs of water-immersion deconditioning by comparing the orthostatic and fluid-electrolyte-endocrine responses of five male subjects before and after these tests. It was found that six months of training has no significant effect on 60-deg head-up tilt tolerance. Thus, during pretraining, the water immersion tilt-tolerance was found to decrease from about 74 min before to 34 min after water immersion, while during posttraining, water immersion tilt tolerance decreased from 74 min to 44 min. Fluid-electrolyte-endocrine responses were also essentially the same during all four tilts. Plasma volume decreased by 9.0 to 12.6 percent; plasma sodium and osmotic concentrations were unchanged; and serum protein and plasma renin activity increased. I.S.

A88-26724

HEALTH PROFILE OF U.S. NAVY PILOTS OF ELECTRONICALLY MODIFIED AIRCRAFT

RALPH G. BURR and ANNE HOIBERG (U.S. Navy, Naval Health Research Center, San Diego, CA) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 59, Feb. 1988, p. 168-171. Navy-supported research. refs

This study compared hospitalization rates of pilots who primarily flew electronically modified aircraft ($n = 1063$) with an age-matched group of pilots who flew other types of aircraft ($n = 2126$). Of the two groups, control pilots at ages 21-26 had a significantly higher mortality rate for aviation-related injuries and a higher hospitalization rate for the diagnostic category of accidents, poisonings, and violence. Their hospitalization rates also were significantly higher than pilots of electronically modified aircraft for mental disorders at ages 27-32 and supplementary classifications

at ages 39-44. Significant age-specific increases in rates were observed for cardiovascular disease and alcoholism in the control group, whereas no significant increases were noted for pilots of electronic models. Pilots in the latter group had low rates for conditions postulated as related to radiation exposure. Such results indicated that pilots of electronically modified aircraft were not at increased risk for illness or injury because of the aircraft models they primarily flew. Author

A88-27145

DYNAMIC EKG-MONITORING IN THE DIAGNOSIS OF PAINLESS MYOCARDIAL ISCHEMIA IN FLIGHT PERSONNEL [DINAMICHESKOE EKG-MONITORIROVANIYE V DIAGNOSTIKE BEZBOLEVOI FORMY ISHEMICHESKOI BOLEZNI SERD TSA U LETCHIKOV]

V. I. SINOPAL'NIKOV and A. V. PULIK *Voenno-Meditsinskii Zhurnal* (ISSN 0026-9050), Nov. 1987, p. 49-52. In Russian.

The diagnostic value of the dynamic EKG-monitoring in the detection of painless myocardial ischemia in flight personnel was investigated. In the experiments, results of the dynamic EKG monitoring carried out during periods of regular activity were related to the clinical data of subjects displaying no discomfort or definite symptoms of myocardial ischemia. Among 57 subjects examined, the presence of ischemia was diagnosed in five pilots who considered themselves healthy. In three of these subjects, the subsequent investigations have detected coronary insufficiency. I.S.

A88-27484

BAROREFLEX FUNCTION IN ENDURANCE- AND STATIC EXERCISE-TRAINED MEN

MICHAEL L. SMITH, HOWARD M. GRAITZER, DONNA L. HUDSON, and PETER B. RAVEN (Texas College of Osteopathic Medicine, Fort Worth) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, Feb. 1988, p. 585-591. Research supported by the Minnesota Heart Association and Parker B. Francis Foundation. refs
(Contract F33615-83-D-0602-0021; NIH-HL-34397)

The effect of exercise training mode on the reflex cardiovascular control was investigated by comparing the baroreflex chronotropic responsiveness of sedentary untrained (UT), endurance-exercise-trained (ET), and weight trained (WT) subjects during both a hypotensive stress (using progressive lower-body negative pressure, LBNP) and a hypertensive stress (using gradually increasing stimulation by phenylephrine, PE, infusion). No significant differences in forearm blood flow or resistance were observed between the groups at any dose of PE. To evaluate the baroreflex function, the regression analysis of heart rate against mean blood pressure during PE infusion was performed, yielding correlation coefficients ranging from 0.82 to 0.92. The slope of the line of best fit for the ET subjects (-0.57) was significantly less than the slopes obtained for either the UT (-0.91) or WT (-0.88) subjects. The results obtained during LBNP stress showed a similar attenuation of reflex control in the ET subjects. I.S.

A88-27487

REFLEX CONSTRICTION OF HUMAN LIMB RESISTANCE VESSELS TO HEAD-DOWN NECK FLEXION

LOUIS K. ESSANDOH, DANIEL A. DUPREZ, and JOHN T. SHEPHERD (Mayo Clinic, Rochester, MN) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 64, Feb. 1988, p. 767-770. refs
(Contract NIH-HL-05883)

The effect of head-down neck flexion on forearm and calf blood flow was investigated using 10 normal human subjects who, at the beginning of experiment, were lying prone with the neck slightly extended and the chin resting on a soft-padded support at the edge of the table. At the start of the head-down neck flexion measurements, the chin support was removed, and the subjects maximally flexed and lowered the neck. Neck flexion was found to cause a rapid decrease in blood flow in both forearm and calf, averaging 39 and 35 percent, respectively at 30 sec. As the neck flexion was sustained, the flow in both forearm and calf

gradually recovered and approached the control values at the end of 10 min. The flow at the ankle, the arterial blood pressure, and the heart rate were not changed, indicating that the decrease occurred in the skeletal muscles and that it was due to vasoconstriction. I.S.

A88-27705

EUROPEAN EXPERIMENTS ON THE VESTIBULAR SYSTEM DURING THE SPACELAB D-1 MISSION

R. VON BAUMGARTEN (Mainz, Universitaet, Federal Republic of Germany), A. BENSON (Royal Air Force, Institute of Aviation Medicine, Farnborough, England), A. BERTHOZ (CNRS, Laboratoire de Physiologie Neurosensorielle, Paris, France), W. BLES (Centrale Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek, Instituut voor Zintuigfysiologie TNO, Soesterberg, Netherlands), TH. BRANDT (Neurologische Klinik Grosshadern, Munich, Federal Republic of Germany) et al. IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 477-490. CNES-supported research. refs.

(Contract BMFT-01-OV-223-9)

The objectives, methods and results of a series of experiments on the vestibular system conducted during the Spacelab D-1 Mission are discussed. Results are reported in detail on the threshold for detection of whole-body linear movement, the adaptation of the optokinetic and vestibuloocular reflexes, the caloric stimulation of the vestibular organs, the influence of neck position receptors on orientation under microgravity conditions. For the same conditions, results are reported for tests of spatial orientation following passive rotations, tests of ocular counterrotation, luminous line tests, dynamic tilt and tilting room tests, and the effects on motion and space sickness and crew observations. C.D.

A88-27707

VENOUS PRESSURE IN SPACE

K. L. KIRSCH, L. ROECKER, and F. HAENEL (Berlin, Freie Universitaet, Federal Republic of Germany) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 500-503. refs

Venous pressure measurements taken during the first Spacelab Mission, 22 hrs after launch, revealed surprisingly low values. Since these measurements were taken 22 hrs after launch, it was thought that an adaptive mechanism had overridden the original high venous pressure levels. Consequently, venous pressures in four astronauts were measured before, during, and after spaceflight during the D1 Mission, with the first measurements being taken 20 min after launch. Body weights before and after the flight were measured, and hematocrits were obtained during the flight. The new results showed that low venous pressures generally obtained in-flight. At no time did the pressure level exceed the control values taken on the ground. Hematocrit values were elevated in space, and the body weight was reduced by 4-9 percent of the control value after flight. The results are in line with those obtained during the first Spacelab Mission. C.D.

A88-27708

TONOMETRY UNDER MICROGRAVITY CONDITIONS

J. DRAEGER, H. WIRT, and R. SCHWARTZ (Hamburg, Universitaet, Federal Republic of Germany) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 503-509.

The development of a tonometer to measure the intraocular fluid pressure in spaceflight is reported, and the results of its use during the D1 Mission is described. An increase of the pressure of about 30 percent was observed during the early phase of the flight. The performance of the tonometer is discussed, and new

instruments which could give a more precise determination of the diurnal rhythm of the intraocular pressure are described. C.D.

A88-27709

EARLY ADAPTATION OF BODY FLUID AND CARDIAC PERFORMANCE TO CHANGES IN G-LEVEL DURING SPACE FLIGHT

F. BAISCH, L. BECK, M. D. SAMEL, A. SAMEL (DFVLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany), and L. D. MONTGOMERY (SRI International, Menlo Park, CA) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 509-514. refs

The impedance technique was used in an attempt to quantify the redistribution of body fluids that occurs in weightlessness and to determine its time course. The effect that fluid redistribution has on the heart was observed. Changes in autonomic tone occurring during fluid redistribution are shown. C.D.

A88-27712

INFLIGHT AND POSTFLIGHT RESULTS ON THE CAUSATION OF INVERSION ILLUSIONS AND SPACE SICKNESS

H. MITTELSTAEDT (Max-Planck-Institut fuer Verhaltensphysiologie, Seewiesen, Federal Republic of Germany) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 525-536. refs

Incidents of space sickness and inversion illusion occurring in the first two Spacelab missions are compared with postflight measurements of space perception parameters to study the relationships between them. It is found that postural bias, as measured postflight in five astronauts, shows a significant and strong negative correlation to the occurrence of inversion illusions and to five parameters of space sickness reported by these astronauts. A significant and strong positive correlation is found between occurrences of inversion illusion and space sickness. Head-to-trunk coordinate transformation is discussed as a possible causal link between postural bias and space sickness. Opportunities for relevant selection and training of astronauts are pointed out. C.D.

A88-27713

ARM POSITIONING IN MICROGRAVITY DURING D1 CHALLENGER FLIGHT

F. VERINGA (Groningen, Rijksuniversiteit, Netherlands) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 537-540. refs

This paper reports an experiment designed to determine how well limb movement is preserved in microgravity without visual feedback. In the experiment, nonballistic antelexion of the stretched arm at the shoulder joint was executed repeatedly in the upright position with the eyes closed and the head stationary both preflight and in-flight, and comparison was made with a control population. The results are discussed in the light of a finding by Ockels on semivoluntary arm abduction after isometric exertion. The influence of clothing on the results is also considered. C.D.

A88-28026

MYSTERY OF RED CELL AGGREGATION UNDER ZERO GRAVITY

LEOPOLD DINTENFASS (Sydney, University, Australia) Medical Journal of Australia (ISSN 0025-729X), vol. 143, Sept. 30, 1985, p. 281-283. Research supported by the Department of Science and Technology of Australia, Esso Australia, Ltd., CSIRO, et al. refs

The morphology of red cells and spontaneously formed red-cell aggregates was studied in conditions of both zero gravity (aboard

the STS 51-C mission) and on ground. In space, red cells from predrawn blood were photographed during first nine hours after steady orbit was attained. Many of the results were unexpected: (1) red cells in vitro retained their normal shape in space, even though red cells drawn from astronauts after flight displayed bizarre shapes; (2) red cell aggregates formed in space were smaller (not larger) than those of normal blood photographed on ground. However, unlike the sludge-like red-cell aggregates formed on ground, the space-formed aggregates were of the rouleaux type, similar to the aggregates found on ground in patients with a history of heart disease and cancer. I.S.

A88-28028

EXPERIMENT ON THE SPACE SHUTTLE FLIGHT STS 51-C - AGGREGATION OF RED BLOOD CELLS IN DISEASE

LEOPOLD DINTENFASS, PETER D. OSMAN, and H. JEDRZEJCZYK (Rachel Forster Hospital, Redfern; Sydney, University, Australia) Australasian Physical and Engineering Sciences in Medicine (ISSN 0158-9938), vol. 8, no. 3, 1985, p. 110-115. Research supported by the Philip Bushell Foundation, Department of Science and Technology, CSIRO, et al. refs

An experiment performed aboard the Space Shuttle to study the kinetics and morphology of red cell aggregation under zero gravity is discussed. The results indicate that red cells do not change shape under zero gravity and that aggregation of red cells does occur under zero gravity, the preferred morphology being rouleaux (cells arranged as pearls on a string). The degree of settling or sludging is much greater on the ground than under zero gravity conditions. C.D.

A88-28029

RED CELLS UNDER ZERO GRAVITY

LEOPOLD DINTENFASS (Sydney, University, Australia) The Lancet (ISSN 0099-5355), March 30, 1985, p. 747, 748. Research supported by the Philip Bushell Foundation, Department of Science and Technology, CSIRO, et al. refs

Blood cells from healthy donors and from patients with a variety of medical disorders were flown aboard the STS 51-C Space Shuttle mission in order to investigate the behavior of red blood cells under zero gravity. The red cells were found to remain normal under zero gravity. Aggregation proceeded normally in all the samples, indicating a possible beneficial effect of zero gravity on red cell aggregation morphology. The results suggest that previously reported changes in the shape of red cells in astronauts are not directly due to gravity, but may be secondary changes related to calcium metabolism. R.R.

A88-28689* Rockefeller Univ., New York.

CONTROL OF ABDOMINAL AND EXPIRATORY INTERCOSTAL MUSCLE ACTIVITY DURING VOMITING - ROLE OF VENTRAL RESPIRATORY GROUP EXPIRATORY NEURONS

ALAN D. MILLER, L. K. TAN, and ICHIRO SUZUKI (Rockefeller University, New York) Journal of Neurophysiology (ISSN 0022-3077), vol. 57, June 1987, p. 1854-1866. refs (Contract NSF BNS-83-17651; NIH-NS-20585; NIH-NS-02619; NIH-RR-07065; NAG2-164; NSG-2380)

The role of ventral respiratory group (VRG) expiratory (E) neurons in the control of abdominal and internal intercostal muscle activity during vomiting was investigated in cats. Two series of experiments were performed: in one, the activity of VRG E neurons was recorded during fictive vomiting in cats that were decerebrate, paralyzed, and artificially ventilated; in the second, the abdominal muscle activity during vomiting was compared before and after sectioning the axons of descending VRG E neurons in decerebrate spontaneously breathing cats. The results show that about two-thirds of VRG E neurons that project at least as far caudally as the lower thoracic cord contribute to internal intercostal muscle activity during vomiting. The remaining VRG E neurons contribute to abdominal muscle activation. As shown by severing the axons of the VRG E neurons, other, as yet unidentified, inputs (either descending from the brain stem or arising from spinal reflexes) can also produce abdominal muscle activation. I.S.

N88-16757# Eidgenossische Technische Hochschule, Zurich (Switzerland). Lab. fuer Biochemie.

WHITE BLOOD CELLS IN SPACE: AN EXPERIMENT FOR THE FIRST SPACELAB MISSION

A. COGOLI and A. TSCHOPP In ESA, ESA Bulletin No. 24 p 24-27 Nov. 1980

Avail: NTIS HC A05/MF A01

An experiment to test the effect of weightlessness on lymphocyte proliferation in Spacelab is proposed. It tests the reactivity of human lymphocytes in vitro, to study the efficiency of the immune system during and after space flight. Experiment hardware and design are outlined. Author (ESA)

N88-17181# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

A-SCAN ULTRASOUND MEASUREMENT OF OCULAR CHANGES DURING ACCOMMODATION M.S. Thesis

DENNIS L. SMITH Apr. 1987 225 p

(AD-A186818; AFIT/CI/NR-87-42T) Avail: NTIS HC A10/MF A01 CSCL 06E

An A-mode ultrasound unit was used to investigate how the principle refractive surfaces of the eye changed during the act of accommodation. Sixteen volunteers took part in an investigation where changes were studied in both the cyclopleged and noncyclopleged state. Measurements of axial length, anterior chamber, lens thickness, and vitreous chamber depth were made at three different accommodation response levels over time. These results showed no significant change in axial length or vitreous chamber depth of the eye from cycloplegia to any accommodative response level. The depth of the anterior chamber and thickness of the lens showed significant changes at each of the three accommodative response levels. The results are consistent with the Helmholtz-Fincham theory of accommodation. This study also demonstrated the time course of action of two drops of 1 percent cyclopentolate with full cyclopentolate cycloplegia reached between 35 and 45 minutes for subjects with dark irides. GRA

N88-17182# Army Research Inst. of Environmental Medicine, Natick, Mass.

ROLE OF BODY FAT IN THE PREDICTION OF THE METABOLIC RESPONSE FOR IMMERSION IN COLD WATER

PETER TIKUISIS, RICHARD R. GONZALEZ, ROBERT A. OSTER, and KENT B. PANDOLF Jun. 1987 24 p

(AD-A186914; USARIEM-M44-87) Avail: NTIS HC A03/MF A01 CSCL 06J

Several empirical models for predicting the metabolic response to a lowered body temperature were evaluated against available data of young healthy males immersed in cold water under resisting conditions. Nude immersions took place in 20 and 24 C water for 1 hour and clothed immersions took place in 10 and 15 C for 3 hours. The data were pooled according to low and high percent body fat (percent BF). Decreases in the mean weighted skin temperature (Tsk) ranged from 5.3 to 11.9 C and decreases in the core temperature (Tc) ranged from 0.56 to 1.54 C, while increases in the metabolic rate over the immersion period ranged from 34 to 256 W. Through regression analysis, an inverse relationship between percent BF and the metabolic response for a given lowered Tsk and lowered Tc was established. When this relationship was explicitly applied to the models, significant improvements in their predictive capability were found. Variables such as body weight, body surface area and rate of change of Tsk were not found to contribute to the predictive capability of the models. Physiology effects; Hypothermia. GRA

N88-17183# Texas A&M Univ., College Station. Bioengineering Program.

VITAL SIGNS RATE METER Final Report, Oct. 1985 - Sep. 1986

CHARLES S. LESSARD, WING C. WONG, ERIC T. SCHORSCH, JAE-JOONG IM, and STEVE MESIBOV Sep. 1987 52 p (Contract F33615-83-D-0602)

(AD-A187015; USAFSAM-TR-87-14) Avail: NTIS HC A04/MF A01 CSCL 06L

The design of the vital signs rate meter described in this report is an outgrowth from previous studies on noninvasive measurement methods and systems for vital signs detection. The purpose of the vital signs rate meter is to assist medical technicians in performance of triage within a toxic environment. Two of the primary physiological measures obtained during an emergency assessment are respiration rate and heart rate. The vital signs rate meter is a combination of hardwired circuits and programmable logic (software). The prototype rate meter includes a microphone and a set of dry electrodes as the sensor array. A simple holder was designed to hold the sensors. Separate signal lines connect the transducers to the electronic circuits enclosed in an aluminum box. Analog signal detection and preconditioning are accomplished with analog circuitry. The conditioned signal is converted into binary format as input to the digital signal processing part of the device. A microprocessor is used as the basis for a design which provides flexibility and potential for future expansion of the device. Programs were written to perform additional signal conditioning, identification of signal, calculation of rates and control of display rate and format. The vital signs rate meter measures and displays heart rate and respiration rate in a digital format. GRA

N88-17184# New York Univ., New York.

BIOPHYSICAL AND BIOCHEMICAL MECHANISMS IN SYNAPTIC TRANSMITTER RELEASE Annual Report, 1 Sep. 1986 - 31 Aug. 1987

RODOLFO R. LLINAS 28 Sep. 1987 13 p (Contract AF AFOSR-0368-65)

(AD-A187059; AFOSR-87-1496TR) Avail: NTIS HC A03/MF A01 CSCL 06A

Four major goals were accomplished in the second year. Two related to synapsin 1 regulation of transmitter release and two related to the temperature dependence of the synaptic release process with a preliminary study of quantal release at the squid giant synapse. The results may be summarized as follows: (1) Demonstration that the dephosphorylated tail fragments of synapsin 1 do not regulate synaptic release which excludes the possibility that tail fragments themselves can prevent vesicular release. (2) Injection of head phospho synapsin 1 does not regulate synaptic release, demonstrating that the molecule itself does not interfere with vesicular fusion. These two experiments indicate that synapsin 1 works by affixing the synaptic vesicles to the cytoskeletal system. (3) Video-enhanced microscopy results demonstrated that axoplasmic mobility is not altered by either tail fragments or head phospho synapsin 1, confirming the findings obtained by the electrophysiological study. The results demonstrate the mechanism by which synapsin 1 regulates transmitter release. A study of the temperature dependence of transmitter release demonstrated that temperature can be used to study the kinetics of synapsin 1 inhibition of transmitter release. Measurements of miniature potentials were finally accomplished routinely and can now be utilized as a technique to determine directly the effect of synapsin 1 on single vesicular fusion. GRA

N88-17185# Vermont Univ., Burlington. Coll. of Medicine.

MOLECULAR MECHANISMS OF NEURONAL RESPONSIVITY Final Scientific Report, 15 Jan. 1986 - 15 May 1987

YIGAL EHRLICH 10 Jul. 1987 19 p (Contract AF AFOSR-0089-86)

(AD-A187061; AFOSR-87-1463TR) Avail: NTIS HC A03/MF A01 CSCL 06B

This paper lists the registrants scheduled to attend the conference and a list of papers presented in the field of Molecular mechanisms of neuronal responsivity. GRA

N88-17186# Army Research Inst. of Environmental Medicine, Natick, Mass.

THE ROLE OF HYDRATION ON PERIPHERAL RESPONSE TO COLD Final Report

DONALD E. ROBERTS and JOEL J. BERBERICH 6 Aug. 1987 21 p

(AD-A186448) Avail: NTIS HC A03/MF A01 CSCL 06J

Ten men were dehydrated by restriction of fluid intake and by exercise over 2-1/2 days (weight loss: 4.6%). Body weight returned to -1.6% within 10 hours after rehydration, suggesting the weight loss was fluid loss. Measures of blood and urine constituents also were indicative of dehydration. These subjects experienced a cold test prior to and after dehydration and after rehydration. The fingers, but not the back of the hand, of the dehydration group were significantly colder (P less than 0.5) following dehydration. A group of 10 control subjects tested under identical conditions, but hydrated at all times, showed no changes. GRA

N88-17187# National Aerospace Medical Centre, Soesterberg (Netherlands).

DOES THE KNIFE OPEN PERSPECTIVES FOR THE MYOPIC PILOT? [BIEDT HET MES PERSPECTIEF AAN DE BIJZIENDE VLIEGER?]

A. C. H. VANDENHEUVEL Jun. 1985 19 p In DUTCH (ETN-87-90166) Avail: NTIS HC A03/MF A01

Research on radial keratotomy for myopia was reviewed. Post operation results, degree of myopia correction, the factors that affect the results of keratotomy, and complications are discussed. The present status does not encourage positive advice as to radial keratotomy for pilots, especially for professional pilots. ESA

N88-18123# Joint Publications Research Service, Arlington, Va. **MEDICAL AND PSYCHOLOGICAL PROBLEMS OF ASSURING FLIGHT SAFETY UNDER PRESENT CONDITIONS**

S. A. BUGROV and V. A. PONOMARENKO In its JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 1-8 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 4-10

Avail: NTIS HC A08/MF A01

At the present time flight safety can be provided only if aviation medicine requirements are taken into consideration. Maintenance of good health, high performance, and profession longevity of the flight and ground crewmen requires that flight surgeons and aerospace medicine specialists revise their position and eliminate various shortcomings in their work. Those latter include: lack of data about correlations between health problems and decline of performance, risk factors and professional longevity; inadequate use of systemic analysis for evaluating man-machine interactions; low priority of the investigation needed to organize proper prophylaxis of diseases. Proposals and suggestions are discussed with respect to the new types and methods of medical support of flight safety at the current and advanced levels of development of aviation technology. Author

N88-18131# Joint Publications Research Service, Arlington, Va. **ROLE OF OPTOKINETIC STIMULATION IN VESIBULOSPINAL REFLEXES**

YU. V. KRYLOV, V. V. IVANOV, A. A. PODSHIVALOV, and V. V. ZARITSKIY In its JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 50-56 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 36-41

Avail: NTIS HC A08/MF A01

Data are presented concerning the effect of optokinetic stimulation (OKS) on vestibulospinal reflexes and discusses mechanisms of interaction of the vestibular, optic, and proprioceptive sensors during their combined stimulation. The vestibulospinal reflexes were investigated using a 2 minute step test and simultaneous OKS that was produced on the head of the test subject. During the tests optokinetic nystagmus was

recorded and the angle of the body rotation relative to the initial position was measured. It was found that during the step tests the body turned along the OKS direction, i.e., towards the slow component of optokinetic nystagmus. During leftward OKS the angle of rotation was larger than during rightward OKS: $406.4 \pm$ or -75.9 deg and $207.5 \pm$ or -40.7 deg, respectively. During leftward OKS loss of equilibrium was recorded 4.5 times more often than during rightward OKS. It was demonstrated that the capacity to track stimuli moving to the left is lower than that to pursue stimuli moving to the right. It was shown that there is a correlation between the rate of optokinetic nystagmus slow phase and the angle of body rotation during the step. It was concluded that optokinetic nystagmus can be used as an informative parameter when measuring statokinetic stability in response to multisensory stimulation. Author

N88-18132# Joint Publications Research Service, Arlington, Va.
MEMBRANE MODEL OF CUPULA OR VESTIBULAR SEMICIRCULAR CANALS

A. V. KONDRACHUK, A. A. SHIPOV, and S. P. SIRENKO *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 57-67 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 41-47

Avail: NTIS HC A08/MF A01

A mathematical model of the time-course variations of the cupula of the semicircular canals of the vestibular apparatus is presented. The model is found to be in good agreement with experimental data which suggests that the cupular matter has viscosity-elasticity properties. Their role in the functioning of the vestibular apparatus is discussed in qualitative terms. The applicability of the membrane model to the description of the time-course variations of the cupula is considered. Author

N88-18133# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF EFFECTS OF SHORT-TERM EXPOSURE TO HIGH CONCENTRATIONS OF CARBON MONOXIDE ON OPERATOR'S PSYCHOPHYSIOLOGICAL FUNCTIONS

V. YE. YASTREBOV, V. V. KUSTOV, and S. M. RAZINKIN *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 68-72 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, Sep. - Oct. 1987 p 47-50

Avail: NTIS HC A08/MF A01

Experiments on volunteers, aged 26 to 40, demonstrated from a 10 minute exposure to carbon monoxide at a concentration of $900 \pm$ or $-$ mg/cu m caused a significant decline of the quality of the operator's functions. The task performed was a two-dimensional compensatory tracking task combined with mental arithmetics. Some of the test subjects showed symptoms of mild CO intoxication which preceded disorders in the work and were accompanied by an increase of HbCO to $10 \pm$ or $-$ 57 percent. Such an exposure to CO should be regarded as hazardous since it may increase the probability of erroneous actions, particularly, of the flying personnel. Author

N88-18134# Joint Publications Research Service, Arlington, Va.
HUMAN BLOOD GLUTAMIC ACID LEVEL WITH EXPOSURE TO HIGH AMBIENT CONCENTRATIONS OF AMMONIA

V. P. SAVINA, T. F. VLASOVA, and YE. B. MIROSHNIKOVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 73-77 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 50-52

Avail: NTIS HC A08/MF A01

Amino acid metabolism of men kept in an enclosed environment was investigated. A high concentration of ammonia produced a specific redistribution of free amino acids in plasma, with the content of glutamic acid increasing by the end of the study. The estimates of glutamic acid in blood can be used for assessing

maximally allowable concentrations of ammonia in enclosed environments. Author

N88-18136# Joint Publications Research Service, Arlington, Va.
FORECASTING COMPLICATIONS OF CARDIOVASCULAR DISEASE IN FLIGHT PERSONNEL

G. L. STRONGIN, A. S. TURETSKAYA, B. L. GELMAN, and O. N. RODIONOV *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 84-90 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 57-62

Avail: NTIS HC A08/MF A01

The flying personnel of different age groups, including those who continued their professional activity and those who were grounded because of cardiovascular diseases, were followed up for a long period of time. The prognostic value, sensitivity, specificity of various risk factors, symptom, and syndromes of cardiovascular diseases were investigated. Using mathematical prediction methods (Wald's sequential nonhomogeneous statistical test), a diagnostic table for predicting outcomes of cardiovascular diseases for the immediate 5 years was developed. The table was checked and tested on a control sample. The trial showed that the table provided a better accuracy of prediction than the traditional methods normally used to the expertise practice. Author

N88-18137# Joint Publications Research Service, Arlington, Va.
EVALUATION OF SPARE ROOM IN CEREBROSPINAL SYSTEM USING NONINVASIVE METHODS

L. G. SIMONOV, A. K. TSATURYAN, A. S. SARIBEKYAN, and L. G. SHMIDT *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 91-95 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 62-65

Avail: NTIS HC A08/MF A01

A theory according to which fluid volumes and pressures in the cerebrospinal system should be related nonlinearly rather than exponentially. The curve describing elasticity E as a function of pressure P should have two almost linear segments separated by an intercept. This concept is based on experimental and model data suggesting that the cerebrospinal system can be viewed as an elastic cavity which can, at normal and low pressures, trap an additional volume of any CSF component, and shift other components; as a result, this leads to a linear increase in pressure within the cavity. The theoretical concepts found support in comparative invasive-noninvasive studies of the intracranial fluid with the aid of ultrasonic introscope and in postural tests to which patients with cerebral lesions were exposed. A noninvasive technique for measuring fluid volumes and pressures in the cerebrospinal cavity was developed. The technique can be used as a diagnostic tool in the case of intracranial distension.

N88-18138# Joint Publications Research Service, Arlington, Va.
ISOTOPE METHODS OF DETERMINING DISTRIBUTION AND MOVEMENT OF BLOOD IN THE BODY

V. I. LOBACHIK, V. N. KORSUNSKIY, V. I. POPOV, S. V. ABROSIMOV, V. V. ZHIDKOV, and V. A. ANDRETSOV *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 96-100 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 65-67

Avail: NTIS HC A08/MF A01

Migration of blood into the capacitive vessels of the upper half of the body is one of the vivid manifestations of the effect of weightlessness on man. Basic research on the phenomenon of redistribution of blood during space flight is difficult. For this reason, researchers are trying to solve a number of ground-based model experiments with anti-orthostatic hypokinesia. The use of radiotracer methods as a contribution to the problem solving, is discussed. B.G.

N88-18139# Joint Publications Research Service, Arlington, Va.
MUSCLE PRESERVATION IN THE STUDY OF BIOENERGETIC EFFECTS OF HYPOKINESIA

E. S. MAILYAN and L. B. BURAVKOVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 101-104 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 67-70

Avail: NTIS HC A08/MF A01

When studying oxidative phosphorylation in skeletal muscles, a strict time limit on preparing tissues is a mandatory prerequisite. Freezing methods inevitably involve water-ice-water phase transitions. A method of low-temperature preservation of skeletal muscles was developed for subzero temperatures, which precludes the possibility of water crystallization. Muscle tissue was immersed in 20 percent glycerin solution prepared on isolation media (IM) cooled to -5 C and stored on saccharose ice. Two days later conventional methods were used to determine the parameters of oxidative phosphorylation. The use of this method of preserving muscles is justified for the study of energetic reactions in post flight studies. B.G.

N88-18143# Joint Publications Research Service, Arlington, Va.
COMPARATIVE EVALUATION OF ORTHOSTATIC STABILITY FOLLOWING IMMERSION IN HORIZONTAL AND VERTICAL POSITIONS

A. YU. MODIN *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 120-122 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 77-79

Avail: NTIS HC A08/MF A01

Among methods for ground-based simulation of weightlessness, the anti-orthostatic variant of bedrest (head-down tilt) and water immersion have gained the greatest population. The redistribution of fluids and hypodynamia syndrome that are thus simulated are based on various mechanisms. While simulation of these effects by the anti-orthostatic method imposes certain requirements as to position and locomotor activity, these requirements are not as apparent. Theoretically, it could be assumed that compensation of gravity by the ejecting force of the immersion medium levels off both posture-dependent hemodynamic effects of gravity and antigravity component of work associated with motor activity. In particular, there is information to the effect that there is virtually the same polyuric response in horizontal and vertical positions during immersion. This warrants the assumption that the nature of distribution of circulating blood does not change appreciably when the body position is changed in the immersion fluid. The objective was to make a comparative study of the effect of immersions in horizontal and vertical positions on orthostatic resistance of man. Author

N88-18145# Joint Publications Research Service, Arlington, Va.
EFFECT OF ANTIORTHOSTATIC POSITION AND DIFFERENT ILLUMINATION ON SENSITIVITY OF SKIN IN UPPER HALF OF THE BODY TO ULTRAVIOLET RADIATION

I. V. ZUBKOVA, L. V. GUTOVA, and N. YE. PANFEROVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 127-129 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 81-82

Avail: NTIS HC A08/MF A01

No previous studies were made of the effect of redistribution of blood to the upper half of the body, which is inherent in weightlessness, on sensitivity of the skin to ultraviolet radiation (UVR). There is sparse and contradictory information as well concerning the effect of illumination of the skin on its sensitivity to UVR. There are data indicative of both attenuation and enhancement of UV sensitivity of the skin in daylight. For this reason, it is of practical interest to explore questions of the effects of antiorthostatic (head-down tilt) hypokinesia (HDT) and varying

degrees of illumination on the body's capacity to perceive UVR when selecting conditions for preventive exposure of operators to UVR during space flights. Author

N88-18147# Joint Publications Research Service, Arlington, Va.
SECOND ALL-UNION CONFERENCE ON PHYSIOLOGY OF EXTREME STATES AND INDIVIDUAL PROTECTION OF MAN

S. G. SALIVON *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 138-143 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 86-89

Avail: NTIS HC A08/MF A01

Topics discussed at the conference were problems concerned with the effects of adverse ambient temperatures, altered barometric pressure, and toxic factors. Also discussed were psychological problems of human performance under extreme conditions, methods of correcting and restoring the functional state with exposure to extreme factors, questions of individual protection of man and automation of scientific research. B.G.

N88-18151# Joint Publications Research Service, Arlington, Va.
PRESENT STAGE OF SPACE MEDICINE

B. S. ALYAKRINSKIY *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 1-9 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 3-10

Avail: NTIS HC A07/MF A01

Development of Soviet cosmonautics has resulted in considerable achievements referable to many disciplines, including biology and medicine, which originated new scientific directions. Numerous important problems were formulated and solved; results of broad scientific relevance were obtained, and, at the same time, new difficult problems were advanced, which require bold overcoming of many dogmas reinforced by tradition, restructuring of scientific thinking. The real achievements of such restructuring will be the contribution of space medicine to the advances, with which the Soviet Union is celebrating its 70th anniversary of the Great October Socialist Revolution. Author

N88-18152# Joint Publications Research Service, Arlington, Va.
RESULTS OF LONG-TERM ELECTROCARDIOGRAPHIC MONITORING OF COSMONAUTS

YE. M. ROMANOV, N. P. ARTAMONOVA, Z. A. GOLUBCHIKOVA, A. F. ZAVADOVSKIY, M. M. KOROTAYEV, V. R. LYAMIN, and V. D. TURBASOV *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 10-16 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 10-14

Avail: NTIS HC A07/MF A01

Regular electrocardiographic examinations of 21 cosmonauts who made 42 space flights during the years 1964 through 1985 are summarized. Electrocardiographic examinations were performed before, during, and after flight. The most common ECG abnormality recorded was extrasystolic arrhythmia that occurred very frequently during provocative tests. In long-term flights changes in the phase of ventricular repolarization were predominant due to the effects of microgravity and other flight factors. The ECG changes were transient and of insignificant prognostic value. Long after return to Earth three cosmonauts developed ECG changes typical of myocardial infarction, hypertension, or hypertension combined with latent ischemic heart disease. It is maintained that these pathologies were not caused by exposure to space flight effects. Author

N88-18153# Joint Publications Research Service, Arlington, Va.
IMPROVEMENT OF HUMAN TOLERANCE TO HEAD-PELVIS (+Gz) ACCELERATIONS BY INCREASING HYDRATION

A. R. KOTOVSKAYA, S. BARANSKI, D. GEMBIZKA, M. VOITKOWJAK, I. F. VILVILYAMS, and N. I. KOKOVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 17-22 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 14-18

Avail: NTIS HC A07/MF A01

Experiments were performed to determine tolerance to head-to-feet (+Gz) acceleration in 62 test subjects aged 23 to 33. The subjects were rotated in a human centrifuge before and after they consumed water and water-salt supplements under the conditions of normal activity or dry immersion simulating microgravity effects. During the centrifugation experiments the following parameters were recorded: stroke volume and cardiac output, arterial pressure by means of Korotkov sounds, electrolytes, total protein, and hematrit. Water and water-salt supplements were found to produce a beneficial effect on acceleration tolerance: tolerance grew, cardiac arrhythmias developed less frequently. The efficacy of the methods increasing the hydration level was related to the amount of water consumed and retained in the body. It is recommended that a differential approach be used to develop procedures for increasing body hydration to be employed in aerospace medicine. Author

N88-18163# Joint Publications Research Service, Arlington, Va.
EFFECT OF EXOGENOUS CARDIOSYNCHRONIZED COUNTERPULSATION ON HUMAN REGIONAL AND CENTRAL HEMODYNAMICS

KH. KH. YARULLIN, T. D. VASILYEVA, and I. P. NEUMYVAKIN *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 79-85 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 54-58

Avail: NTIS HC A07/MF A01

Variations in regional and central hemodynamics of man under the influence of exogenous contrapulsation (ECP) were examined rheographically. In recumbent subjects, ECP increased cerebral pulse blood filling, particularly of the vertebrobasilar system. It appears that the significant increase of the tone of arterioles and veins may be important when it becomes necessary to correct cerebral circulation in the situations that may lead to brain ischemia. It was found that in the orthostatic tilt test ECP can be an effective tool for enhancing brain and lung blood supply and increasing stroke volume, cardiac output, and blood pressure. This may help maintain homeostasis and improve orthostatic tolerance. The observation that ECP may facilitate blood supply of the vitally important organs, specifically brain, enables us to recommend this procedure to be used at an early stage of readaptation after simulation or real space flights. Author

N88-18164# Joint Publications Research Service, Arlington, Va.
EFFECT OF OXYGEN INHALATION ON RESPIRATORY FUNCTION DURING EXERCISE AND EXPOSURE TO ADDED RESISTANCE TO RESPIRATION

I. S. BRESLAV, G. G. ISAYEV, and K. S. RYMZHANOV *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 86-91 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 59-62

Avail: NTIS HC A07/MF A01

Experiments were performed to investigate the effect of added resistance to inspiratory, expiratory, and inspirator-expiratory respiration on lung ventilation and $P_{sub A} CO_2$ during exercise when breathing air or oxygen. Increase of resistance to respiration, particularly inspiratory-expiratory, reduced the work induced growth of aggravated those shifts significantly. The adverse effect of hyperoxia on the respiration function when exercise was combined

with added resistance to respiration seems to be associated with inhibition of the respiration center produced by the lack of hyperoxid simulations. Author

N88-18165# Joint Publications Research Service, Arlington, Va.
POLAR WORKER ADAPTABILITY TO ANTARCTIC HIGH ALTITUDES

A. A. AYDARALIYEV, A. L. MAKSIMOV, and T. B. CHERNOOK *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 92-98 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 62-66

Avail: NTIS HC A07/MF A01

The examinations were carried out during the 27th Soviet Antarctic expedition. Baseline data were collected before the departure of the test subjects to the Antarctic Region. Prior to their ascent to the high mountain area they were divided into two groups with a high and a low level of hypoxic tolerance in terms of the work capacity index calculated on the basis of standard bicycle ergometry tests. Heart rate, body temperature, and salivary content of sodium and potassium were measured 6 times a day at 4 hour intervals. The results obtained were treated by nonparametric tests. It was found that on adaption day 30 the subjects with low hypoxic tolerance and nonspecific resistance developed changes in biorhythm amplitudes and phases and showed ultradian components with a 12 hour period. By contrast, the subjects with high hypoxic tolerance retained the ability to maintain circadian patterns. By the middle of the wintering time the circadian rhythms shifted towards ultradian components regardless of individual hypoxic tolerance. Author

N88-18167# Joint Publications Research Service, Arlington, Va.
TWO-DIMENSIONAL STATIC OTOLITH MODEL

A. V. KONRACHUK and S. P. SIRENKO *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 104-115 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 70-76

Avail: NTIS HC A07/MF A01

A model of the otolith as a system with distributed parameters in which the otolith is described by a two-dimensional elastic plate fixed at its sides is presented. The behavior of the model in response to centrifugal and gravitational forces is discussed. Comparison of this model with experimental data yields the value of Young's module of the otolith membrane equal to 100 to 1000 dyne/sq cm. It is shown that deformations of different compartments of the otolith are dissimilar even for a homogeneous otolith membrane, depending on its configuration and orientation relative to the force vector. It is concluded that intralabyrinthine pressure may be the cause of original nonhomogeneous deformation of hairs in receptor cells at rest. Author

N88-18168# Joint Publications Research Service, Arlington, Va.
COMBINED EFFECT OF IONIZING RADIATION AND ALTERED GAS ATMOSPHERE ON CENTRAL NERVOUS SYSTEM

B. I. DAVYDOV, I. B. USHAKOV, and V. P. FEDOROV *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 116-125 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 76-83

Avail: NTIS HC A07/MF A01

When the brain is exposed to ionizing radiation, marked changes may develop rather soon in its structures, which lead to neurological disorders, as a result of edema, as demonstrated in clinical practice and experimentally. However, the mechanisms of development of these disturbances were still not sufficiently investigated, while the feasibility of modifying radiation effects in the central nervous system (CNS) by changing the inhaled gas mixture is unjustifiably doomed to failure by some authors, and this is in fact in contradiction to the universal law of radiobiology, the oxygen effect,

which was well-studied in other critical systems. At the present time, there is no unequivocal answer to the question of direction of modification of radiation effects in the CNS with use of an altered gas atmosphere. For this reason, 67 dogs of both sexes weighing 7 to 12 kg were studied. The results are examined.

Author

N88-18169# Joint Publications Research Service, Arlington, Va.
**EFFECT OF HYPERCAPNIC-HYPOXIC TEST ON
 CARIORESPIRATORY PARAMETERS OF INDIVIDUALS WITH
 NEUROCIRCULATORY DYSTONIA**

A. S. NEKHAYEV, V. D. VLASOV, V. K. STEPANOV, and YU. I. ANDRIYENKO *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 126-130 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 83-86
 Avail: NTIS HC A07/MF A01

Twenty healthy men and twelve patients with hypertensive type neurocirculatory dystonia belonging to the flying personnel were examined. A hypercapnic-hypoxic mixture formed during rebreathing in a closed circuit without a CO₂ absorber was breathed. In both groups this provocative test produced similar variations of most parameters under study. However in contrast to the healthy men, the hypertensive subjects showed a lower compensatory hyperventilation, a greater increase of blood pressure and cardiac output and a relatively small decrease of total peripheral resistance. Three test subjects displayed sinus arrhythmia. The time of test tolerance in the patients was on the average 20 percent shorter than in the healthy subjects. The changes can be viewed as an indication that the reserve capability of the cardiorespiratory system declines. The fact that the test is rapid, simple, and safe makes it possible to use it during regular medical monitoring of the flying personnel with functional disorders of the cardiovascular systems.

Author

N88-18170# Joint Publications Research Service, Arlington, Va.
**OXIDATIVE ENZYME ACTIVITY IN HEALTHY SUBJECTS AND
 INDIVIDUALS WITH NEUROCIRCULATORY DYSTONIA DURING
 GRADED EXERCISE**

YE. G. VETROVA and I. A. POPOVA *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 131-135 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 86-89
 Avail: NTIS HC A07/MF A01

In response to controlled exercise (50 and 75 percent of maximum workload) malate dehydrogenase (MDH) and isocitrate dehydrogenase (ICDH) varied similarly in healthy men and in patients with hypertensive and hypotensive type neurocirculatory dystonia. However, in neurocirculatory dystonia subjects MDH increase during exercise and normalizes during recovery developed slower than in healthy people. The MDH redistribution between mitochondrial and cytoplasmic fractions remained unchanged.

Author

N88-18171# Joint Publications Research Service, Arlington, Va.
**HEMODYNAMIC EFFECTS OF BETA-ADRENERGIC BLOCKING
 WITH OBSIDAN IN CLINOSTATIC AND ORTHOSTATIC
 POSITIONS**

G. S. BELKANIYA, M. V. GALUSTYAN, V. A. DARTSMELIYA, and A. N. DEMIN *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 136-143 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 90-94
 Avail: NTIS HC A07/MF A01

The objective was to determine the relevance of distinctions of circulatory regulation in clinostatic and orthostatic positions to hemodynamic effects of the beta-adrenergic blocker, obsidan.

Author

N88-18172# Joint Publications Research Service, Arlington, Va.
**NEW BOOK ON METABOLIC ASPECTS OF SPACEFLIGHT
 STRESS**

N. N. DEMIN and R. A. TIGRANYAN *In its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 6, Nov. - Dec. 1987 p 144-145 11 Mar. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 6, Nov. - Dec. 1987 p 95
 Avail: NTIS HC A07/MF A01

Although there is a vast literature already dealing with stress, in-depth investigation of expressly biochemical mechanisms of processes that develop under stress is only beginning. A comprehensive survey of the results of 12 years of rat experimentation is presented. The principle material consists of a detailed presentation of the results of studies of biochemical parameters in the presence of stress-related changes in experimental animals flown in space for 18.5 to 22 days in 1973 to 1979 aboard 5 artificial earth satellites of the Cosmos series.

B.G.

N88-18176# Cranfield Inst. of Tech., Bedford (England). Applied Psychology Unit.

**CARDIOVASCULAR AND SUBJECTIVE MEASURES OF TASK
 DEMAND IN A LOW WORKLOAD MONITORING TASK Summary
 Report**

CAROLE D. BRABY Sep. 1987 24 p
 (REPT-8804; ISBN-0-947767-84-3) Avail: NTIS HC A03/MF A01

A study was conducted in response to a general lack of research into the assessment of the workload which is experienced by the pilot at low levels of task demand. Four existing indices of workload were investigated regarding their sensitivity to two low level task demand situations, i.e., low demand and very low demand. The indices include: (1) The Bedford Workload scale; (2) A five point Alertness scale; (3) Heart rate - measured as the mean inter-beat interval; and (4) Heart rate variability - measured as the standard deviation of the inter-beat interval. A further multidimensional subjective scale which was developed during the study was also employed. This scale consisted of 30 adjectives and phrases which describe feelings of frustration, boredom, and fatigue. Author

N88-18177*# National Aeronautics and Space Administration.
 John F. Kennedy Space Center, Cocoa Beach, Fla.

**RELATIONSHIPS BETWEEN CORONARY HEART DISEASE
 RISK FACTORS AND SERUM IONIZED CALCIUM IN KENNEDY
 SPACE CENTER COHORT**

LISA ANN GOODWIN, MARY ANNE BASSETT FREY, MARION P. MERZ, and WILLIAM R. ALFORD (Bionetics Corp., Cocoa Beach, Fla.) Aug. 1987 24 p
 (Contract NAS10-10285)

(NASA-TM-100979; NAS 1.15:100979) Avail: NTIS HC A03/MF A01 CSCL 06P

Kennedy Space Center (KSC) employees are reported to be at high risk for coronary heart disease (CHD). Risk factors for CHD include high serum total cholesterol levels, low levels of high-density lipoprotein cholesterol (HDL), elevated triglyceride, smoking, inactivity, high blood pressure, being male, and being older. Higher dietary and/or serum calcium Ca(++) may be related to a lower risk for CHD. Fifty men and 37 women participated. Subjects were tested in the morning after fasting 12 hours. Information relative to smoking and exercise habits was obtained; seated blood pressures were measured; and blood drawn. KSC men had higher risk values than KSC women as related to HDL, triglycerides, systolic blood pressure, and diastolic blood pressure. Smoking and nonsmoking groups did not differ for other risk factors or for serum Ca(++) levels. Exercise and sedentary groups differed in total cholesterol and triglyceride levels. Serum Ca(++) levels were related to age, increasing with age in the sedentary group and decreasing in the exercisers, equally for men and women. It is concluded that these relationships may be significant to the risk of CHD and/or the risk of bone demineralization in an aging population. Author

N88-18178# Technische Hogeschool Twente, Enschede (Netherlands).

INTERACTIONS OF CULTURED HUMAN ENDOTHELIAL CELLS WITH POLYMERIC SURFACES Ph.D. Thesis

P. B. VANWACHEM Feb. 1987 147 p
(PB88-112255) Avail: NTIS HC A07/MF A01 CSCL 06P

The aim of the study is to elucidate the mechanisms involved in the in vitro interactions between seeded cultured human endothelial cells (EC) and polymers with different surface properties. Adhesion, spreading, proliferation, and several other functions of cultured human EC have been investigated and related to the surface properties of the polymer substrates. GRA

N88-18179# Helsinki Univ. of Technology, Espoo (Finland). Low Temperature Lab.

REALISTIC CONDUCTIVITY GEOMETRY MODEL OF THE HUMAN HEAD FOR INTERPRETATION OF NEUROMAGNETIC DATA

M. S. HAEMAELAEINEN and J. SARVAS Jul. 1987 24 p
(PB88-112230; TKK-F-A614; ISBN-951-754-152-X) Avail: NTIS HC A03/MF A01 CSCL 06P

The computational and practical aspects of a realistically shaped multilayer model for the conductivity geometry of the human head are discussed. A novel way to handle the numerical difficulties caused by the presence of the poorly conducting skull is presented. With this method, both the potential on the surface of the head and the magnetic field outside the head can be computed accurately. The procedure was tested with the multilayer sphere model, for which analytical expressions are available. The method is then applied to a realistically shaped head model, and it is numerically shown that for the computation of B vector, produced by cerebral current sources, it is sufficient to consider a brain shaped homogeneous conductor only, since the secondary currents on the outer interfaces give only a negligible contribution to the magnetic field outside the head. Comparisons with the sphere model are also included to pinpoint areas where the homogeneous conductor model provides essential improvements in the calculation of the magnetic field outside the head. Author

N88-18180* National Aeronautics and Space Administration, Washington, D.C.

AEROSPACE MEDICINE AND BIOLOGY: A CUMULATIVE INDEX TO A CONTINUING BIBLIOGRAPHY (SUPPLEMENT 306)

Jan. 1988 210 p
(NASA-SP-7011(306); NAS 1.21:7011(306)) Avail: NTIS HC A10 CSDL 06E

This publication is a cumulative index to the abstracts contained in the Supplements 294 through 305 of Aerospace Medicine and Biology: A Continuing Bibliography. It includes seven indexes - subject, personal author, corporate source, foreign technology, contract number, report number, and accession number. Author

N88-18181* National Aeronautics and Space Administration, Washington, D.C.

CERTAIN ASPECTS OF HUMAN METABOLISM DURING SPACEFLIGHTS OF VARYING DURATION

A. I. GRIGORYEV, I. A. POPOVA, and A. S. USHAKOV Mar. 1988 36 p Transl. into ENGLISH of Nekotoryye Storony Obmena Veshchestv Cheloveka v Kosmicheskikh Poletakh Razlichnoy Prodolzhitel'nosti presented at 1st Meeting of the Joint Soviet-American Working Group on Space Biology, 1987 Meeting held in Nalchik, USSR, 2-11 Aug. 1987 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASW-4307)
(NASA-TT-20215; NAS 1.77:20215) Avail: NTIS HC A03/MF A01 CSCL 06P

A comparative analysis is made of hormone reactions after short and long term spaceflights. Endocrinological indicators from venous blood and daily urine samples of cosmonauts completing flights lasting from 7 to 237 days were examined. No pathological indicators were found in the metabolic shifts in the erythrocytes and disruption of the functional state of their membranes. Author

N88-18182* National Aeronautics and Space Administration, Washington, D.C.

BASIC RESULTS OF MEDICAL STUDIES DURING PROLONGED MANNED FLIGHTS ON-BOARD THE SALYUT-7/SOYUZ-T ORBITAL COMPLEX

Mar. 1988 64 p Transl. into ENGLISH of conference paper presented at the 1st Joint Soviet-American Working Group on Space Biology and Medicine, 1987 Meeting held in Nalchik, USSR, 2-11 Aug. 1987 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASW-4307)
(NASA-TT-20217; NAS 1.77:20217) Avail: NTIS HC A04/MF A01 CSCL 06S

From 1982 through 1986 six extended flights (from 65 to 237 days) were carried out in the Salyut-7/Soyuz-T orbital complex by the principal crews, and five short-term flights (8 to 12 days) by visiting crews. During these flights, a broad series of medical studies was performed, their greatest extent during the longest flight (237 days), with the participation of a cosmonaut-doctor. The medical studies were aimed at obtaining additional information and new data on the reactions of the body's basic systems during a prolonged state of weightlessness. Author

N88-18183* National Aeronautics and Space Administration, Washington, D.C.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 308)

Mar. 1988 65 p
(NASA-SP-7011(308); NAS 1.21:7011(308)) Avail: NTIS HC A04; NTIS standing order as PB88-912300, \$9.00 domestic, \$18.00 foreign CSCL 06E

This bibliography lists 175 reports, articles, and other documents introduced into the NASA scientific and technical information system in February, 1988. Author

N88-18184# JAYCOR, San Diego, Calif.

MODELING OF THE NON-AUDITORY RESPONSE TO BLAST OVERPRESSURE Annual Report, 15 Aug. 1985 - 14 Aug. 1986

JAMES H. STUHMILLER 1 Feb. 1987 9 p
(Contract DAMD17-85-C-5238; DA PROJ. 3E1-62777-A-878)
(AD-A187397) Avail: NTIS HC A02/MF A01 CSCL 06N

Mathematical models of the physical processes that cause blast injury are developed so that the results of these tests using animals in simple blast environments can be safely translated to estimating hazard to man exposed to blast both in the free field and within enclosures. This project builds on earlier work performed to develop models of the mechanics of the thorax and lung exposed to simple blast waves. The scope of interest has been expanded to include the lung exposed to simple blast waves. The scope of interest has been expanded to include the lung, and gastro-intestinal tract, the upper respiratory tract, and the tympanic organs, and to include a more extensive investigation of the magnitude and distribution of loading under a wider range of blast situations. The report covers the first year of the contract. Effort was concentrated in formulating a specific mathematical approach to each organ system, collecting and analyzing data from previous field tests, and developing models that can provide preliminary Damage Risk Criteria for the most susceptible organ system, the upper respiratory tract. GRA

N88-18185# Southern Methodist Univ., Dallas, Tex.

THE PRECISION OF LIMITS ON BODILY FLUIDS WHEN USING BETA-EXPECTATION INNER TOLERANCE LIMITS

Y.-M. CHOU and D. B. OWEN 15 Oct. 1987 10 p
(Contract N00014-84-K-0146)
(AD-A187966; SMU-2-288-87) Avail: NTIS HC A02/MF A01 CSDL 06D

A solution is discussed to the problem of setting limits for the normal range for a bodily fluid based on a sample of observations on that bodily fluid. The procedure being considered is known as beta-expectation inner tolerance limits. Also a new criterion is proposed for assessing the precision of these limits for various sample sizes. GRA

N88-18186# Naval Aerospace Medical Research Lab., Pensacola, Fla.

THE ACCOMMODATIVE STATUS IN THE DARK OF US NAVY FIGHTER PILOTS Interim Report

LEONARD A. TEMME and E. L. RICKS Mar. 1987 31 p (AD-A188188; NAMRL-1332) Avail: NTIS HC A03/MF A01 CSCL 05F

Visual accommodation of 172 naval aviators in the dark was measured and compared to their most recent night carrier landing scores and the average distance at which an adversary aircraft was first sighted during air combat maneuver training. No significant correlations were found between the accommodation measures and either measure of operational performance. Reasons for this result are discussed. Accommodation measures in the aviator sample in the dark are compared to measures made in samples of college students reported in the literature. The aviator sample is significantly less myopic than the student sample. For example, only 6 percent of the students have as little myopia as the average naval aviator. This dramatic difference in accommodation could result from either training or some set of selection factors. Possible reasons for this finding and its significance for the Navy are discussed.

GRA

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A88-25076

EFFECTS OF TASK TYPE AND STIMULUS HETEROGENEITY ON THE EVENT RATE FUNCTION IN SUSTAINED ATTENTION

THOMAS M. LANZETTA, WILLIAM N. DEMBER, JOEL S. WARM, and DANIEL B. BERCH (Cincinnati, University, OH) Human Factors (ISSN 0018-7208), vol. 29, Dec. 1987, p. 625-633. refs

The goals of the present experiment were (1) to determine the function relating rate of presentation of neutral background events to accuracy of signal detection in both a simultaneous (comparative judgment) and a successive (absolute judgment) vigilance task, and (2) to test differential predictions from Posner's pathway inhibition theory and Jerison's elicited observing-rate theory about the effects of heterogeneity in the shape of the neutral events. Data for simultaneous and successive tasks at four event rates (6, 12, 24, and 48 events/min) under both homogeneous and heterogeneous neutral-event conditions showed that the event-rate function (a decline in detections with increments in event rate) was steeper for the successive than for the simultaneous task. Consistent with Jerison's view but not with Posner's, stimulus heterogeneity did not moderate the effects of either time on watch or event rate.

Author

A88-25077

A TWO-TERM EXPONENTIAL FUNCTIONAL DESCRIPTION OF THE TIME COURSE OF SUSTAINED ATTENTION

LEONARD M. GIAMBRA and REGINALD E. QUILTER (National Institute of Aging, Baltimore, MD) Human Factors (ISSN 0018-7208), vol. 29, Dec. 1987, p. 635-643. refs

Single-process theories of sustained attention or vigilance have supported the view that the vigilance decrement must be the result of interactions among two or more processes or systems. Attention is presently given to the related hypothesis in which the course of sustained attention is modeled by a function accounting for 96.7 percent of the variance of detection accuracy; this prediction was more accurate than an earlier single-term model by a factor of 1.2, with all parameter estimates being highly statistically significant.

O.C.

A88-25078

SIGNAL DETECTION THEORY AND PROBABILITY MATCHING APPLY TO VIGILANCE

ANGUS CRAIG (Sussex, University, Brighton, England) Human Factors (ISSN 0018-7208), vol. 29, Dec. 1987, p. 645-652. refs

Many vigilance tasks require discrimination of infrequent signal events from frequent nonsignals. During performance on these tasks signal detections often decline. But this does not generally signify a loss of vigilance, if one can rely on signal detection analyses showing that signal discriminability remains constant during a vigil and hence that neither attention nor signal processing has waned. This paper confirms that signal detection theory does provide a good fit to vigilance data and that the analyses can therefore be relied on. The paper also shows that probability matching (of signal reports to signal occurrence) occurs. In the main it is the adjustment of report rate toward matching by an alert observer that produces the vigilance decrement in detections.

Author

A88-25079

AUTOMATIC AND CONTROL PROCESSING APPROACH TO INTERPRETING VIGILANCE PERFORMANCE - A REVIEW AND REEVALUATION

ARTHUR D. FISK (Georgia Institute of Technology, Atlanta) and MARK W. SCERBO (AT&T Systems Evaluation Center, Piscataway, NJ) Human Factors (ISSN 0018-7208), vol. 29, Dec. 1987, p. 653-660. refs

The present paper discusses vigilance phenomena in terms of the automatic/control processing theory (Schneider and Shiffrin, 1977) of attention and human information processing. Fisk and Schneider (1981) interpreted vigilance decrements within the automatic/control process framework and discussed system design implications as well as training methods for vigilance environments. Recent results concerning the effects of various stressors on automatic and control processes are presented. Taken as a whole, these results from vigilance, alcohol intoxication, heat stress, and mental workload experiments highlight why, when addressing sustained attention issues, it is critical to understand the mode of information processing (i.e., automatic/control) available to perform the task.

Author

A88-25080

LIMITATIONS OF THE COGNITIVE VIGILANCE INCREMENT

MICHEL LOEB, THOMAS K. NOONAN, DAN W. ASH, and DENNIS H. HOLDING (Louisville, University, KY) Human Factors (ISSN 0018-7208), vol. 29, Dec. 1987, p. 661-674. refs

This paper contrasts the positive evidence for a cognitive vigilance increment with several unsuccessful attempts at replication and reports three further experiments. Experiment 1 employs six different levels of task complexity involving the use of auditory cues, finding a weak overall decrement over time. Experiment 2 obtains similar results using the original simple and complex tasks in conditions of cuing. Experiment 3 compares three uncued conditions, finding a slight improvement in response times on the most complex task. Reviewing the evidence suggests three groups of reasons for nonreplication: differences in tasks and presentation variables, possible gender differences, and the presence of cue tones. Making allowance for these variables, it is concluded that fixed-range tasks produce an increment whereas variable-range tasks do not, although all the cognitive versions are relatively resistant to decrement.

Author

A88-25081

DIURNAL VARIATION, TASK CHARACTERISTICS, AND VIGILANCE PERFORMANCE

A. CRAIG (Sussex, University, Brighton, England), D. R. DAVIES, and G. MATTHEWS (Aston University, Birmingham, England) Human Factors (ISSN 0018-7208), vol. 29, Dec. 1987, p. 675-684. refs

Three experiments consider the effects of several task features along with the time of day when vigilance was tested. The first experiment found that detections on the Bakan task depended on event rate and signal frequency and that the adverse effects of

lowering signal frequency were more marked in the afternoon than in the morning. The second experiment found that the typical sensitivity decrement on a brief, rapidly paced successive discrimination task occurred earlier when the stimuli were degraded - especially in the early evening as compared with the morning - and that a riskier criterion placement was adopted in the evening. The third experiment used an unpaced simultaneous discrimination task with equiprobable stimulus events. Efficiency was not stable but declined as time passed, while speed increased. These changes tended to be more apparent in the afternoon, and perceptual efficiency seemed genuinely lower than in the morning. The implications for interpretations of vigilance and time-of-day effects are discussed. Author

A88-25082

COMPUTER NETWORK OPERATION - APPLICABILITY OF THE VIGILANCE PARADIGM TO KEY TASKS

LYNN C. PERCIVAL (IBM Corp., Research Triangle Park, NC) and THOMAS K. NOONAN (Human Factors (ISSN 0018-7208), vol. 29, Dec. 1987, p. 685-694. refs

This paper examines the applicability of the vigilance paradigm to the task of monitoring data communication networks. Survey work and the results of usability evaluations of network management products suggest that several key aspects of the vigilance paradigm do apply to this task. The task is prolonged but not necessarily continuous because of time sharing and social interaction. The signals are of the cognitive type and are many and varied. The simple ones are obvious; more difficult ones are not. The signals are infrequent and aperiodic. The frequency is probably lower than in most vigilance experiments, and the response does not have an impact on future signal rate. Often the response to a detected problem is to begin problem recording and troubleshooting. A set of recommendations for modification of the paradigm and experimental parameter values is provided that will make the results of future vigilance experiments more applicable to this type of operational monitoring. A second set of recommendations is provided for improving human performance in this type of system monitoring. Author

A88-25084

VIGILANCE RESEARCH - ARE WE READY FOR COUNTERMEASURES?

ROBERT R. MACKIE (Essex Corp., Goleta, CA) Human Factors (ISSN 0018-7208), vol. 29, Dec. 1987, p. 707-723. refs

It is argued that despite the large volume of vigilance research, only limited progress has been made in formulating principles and testing countermeasures aimed at minimizing the vigilance problem. In part this is due to the design of experiments, including the use of esoteric tasks, limited watch durations, and sterile experimental environments. More rapid progress toward knowledge that can be applied to real-world tasks requiring vigilance will be made if greater attention is given to the critical features of operational tasks in the design of laboratory experiments. Examples are provided of how specificity of human responses to stimulus, temporal, and environmental variables in vigilance experiments could have led investigators to totally erroneous conclusions about the presence of the vigilance decrement and the effectiveness of potential countermeasures. The argument that basic research leads to generalizations of greater scientific power than research studies modeled after real-world conditions is challenged. Author

A88-25439

PILOT AROUSAL DURING THE APPROACH AND LANDING

A. H. ROSCOE (Britannia Airways, Ltd., Luton, England) Aviation Medicine Quarterly (ISSN 0951-3949), vol. 1, March 1987, p. 31-36. refs

Some 60 percent of accidents to commercial aircraft occur during the approach and landing, and overload and complacency have both been considered as contributory factors. The relationship between arousal, as measured by heart rate, and landing performance is discussed using data from a 14-year study carried out at the Royal Aircraft Establishment, Bedford. Examples are presented where inappropriately low levels of arousal were

accompanied by an obvious decrement in performance. It is suggested that the conceptual model of arousal is useful in identifying an important causative factor in some approach and landing accidents. Author

A88-25716

DISTRACTION - ITS EFFECT ON PILOT PERFORMANCE

D. H. T. BAIN (Aviation Medicine Quarterly (ISSN 0951-3949), vol. 1, no. 2, 1987, p. 113-116.

It is shown that distraction is an integral part of the attention mechanism of human consciousness. The extent to which it occurs and its effect on the performance of human pilots is dependent on both environmental and personal factors which can be influenced by aircraft design and pilot training. K.K.

A88-26623

USE OF A BEHAVIOR-BASED PERSONALITY INSTRUMENT IN AVIATION SELECTION

THOMAS T. LAMBIRTH, JOHN D. ALCORN (Southern Mississippi University, Nattiesburg, MS), and GERALD D. GIBB (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, FL) Educational and Psychological Measurement (ISSN 0013-1644), vol. 46, 1986, p. 973-978. refs

This study evaluated a behavioral-based personality instrument currently used by a branch of the United States Armed Forces in their experimental aviation selection battery. The instrument, the Dot Estimation Task (DOT), was designed to measure compulsiveness versus decisiveness. The reliability and validity of this experimental instrument was evaluated. One hundred and fifty three university undergraduate students were administered the DOT and either of two paper-and-pencil compulsivity instruments in a counterbalanced design. Four weeks later, 90 subjects were retested on the DOT and the alternate compulsivity instrument. The results indicate that the DOT has a test-retest reliability of .64 but has no relationship to either compulsivity measure. Author

A88-26712

MENTAL HEALTH FACTORS IN SPACEFLIGHT

CHESTER M. PIERCE (Harvard University, Cambridge, MA) (Space Life Sciences Symposium, Washington, DC, June 24, 1987) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Feb. 1988, p. 99-101.

Prolonged confinement an isolation, such as isolation during Antarctic expeditions or prolonged spaceflight, is stressful for most people, often causing physiological, psychological, and behavioral disturbances. In this paper, the ways for minimizing stress via successful coping of space personnel and the organization of abundant available support are discussed. Studies for achieving these goals should include investigations of the links between the central nervous system, the immune system, and the cardiovascular system in animals and humans; of the psychosocial measures for individual and group circumstances; and the development of better techniques for correlating meteorological and climatological data with biomedical data. It is suggested that one possible site for conducting medical and biological research would be the Antarctica, in a place of no escape for large portions of the year. I.S.

A88-26723

AIRCREW SELECTION - A PROSPECTIVE STUDY

PAUL FROMM, ARNOLD CYJON, MICHAL LOTEM, JOSEPH RIBAK, and MOSHE GROSS (Israel Air Force Aeromedical Center, Ramat Gan) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Feb. 1988, p. 165-167. refs

The medical reasons for rejection among 3000 consecutive applicants for flight training were evaluated, and the effectiveness of the screening process determined by reviewing subsequent medical wastage occurring during flight training. Of the 46 cadets who left the course because of medical reasons, eight withheld information which would have led to their rejection on the original screening examination (epilepsy one, recurrent syncope one, migraine headache two, Crohn's disease one, asthma one, chronic knee pain one, and chronic recurrent headaches one). There were

also two errors in medical processing. The other 36 cases could not have been predicted by current screening procedures. It is concluded that the major deficiency in the screening process is the concealment or withholding of information by candidates for flight training. Author

A88-27144

THE POSSIBILITIES OF THE PERCEPTION AND PROCESSING OF COMPLICATED SPEECH INFORMATION BY AN OPERATOR [O VOZMOZHNOSTIAKH VOSPRIIATII I PERERABOTKI OPERATOROM SLOZHNOI RECHEVOI INFORMATSII]

G. I. TARASENKO, G. E. SHCHERBACHENKO, and I. A. PETLENKO Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Oct. 1987, p. 48, 49. In Russian.

This paper considers the conditions under which a crewmember can isolate emergency stand-by commands from a stream of general information in the presence of intense acoustic interference. In the experiments, trained aircraft operators were asked to correctly identify warning-type commands (WCs) given (by means of a head phone) by a female voice simultaneously with general information messages (IMs) presented by a male voice. The commands and messages were presented with or without background noise. In the second series, a 'vocal cocktail' was used, when the simultaneous presentation of the WCs and IMs was superimposed by 'speech tables'. The results of these studies indicate that the efficiency of the WC perception depends upon the intensity and frequency characteristics of the commanding voice. Training had a significant effect; however, when subjects were trained in the absence of background noise, the effect of training was nullified upon the introduction of 105-110 dB noise. I.S.

A88-27706* Massachusetts Inst. of Tech., Cambridge.
PERCEPTION OF LINEAR ACCELERATION IN WEIGHTLESSNESS

A. P. ARROTT (MIT, Cambridge, MA) and L. R. YOUNG (Payload Systems, Inc., Wellesley, MA) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 490-499. refs (Contract NASW-3651)

Eye movements and subjective detection of acceleration were measured on human experimental subjects during vestibular sled acceleration during the D1 Spacelab Mission. Methods and results are reported on the time to detection of small acceleration steps, the threshold for detection of linear acceleration, perceived motion path, and CLOAT. A consistently shorter time to detection of small acceleration steps is found. Subjective reports of perceived motion during sinusoidal oscillation in weightlessness were qualitatively similar to reports on earth. C.D.

A88-27710

MASS DISCRIMINATION AND ADAPTATION TO WEIGHTLESSNESS

H. E. ROSS (Stirling, University, Scotland), E. SCHWARZ (DFVLR, Cologne, Federal Republic of Germany), and P. EMMERSON (Aston, University, Birmingham, England) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 515-517.

An experimental study on mass discrimination under conditions of weightlessness is reported. The experiments, conducted aboard the D1 Mission, involved estimating the weight of balls shaken in the hand. A greater impairment was found for long shakes than for short shakes, and acceleration was found to improve the quality or quantity of sensory information for inertial mass. C.D.

A88-27711

SPATIAL DESCRIPTION IN MICRO-GRAVITY - ASPECTS OF COGNITIVE ADAPTATION

A. D. FRIEDERICI and W. J. M. LEVELT (Max-Planck-Institut fuer Psycholinguistik, Nijmegen, Netherlands) IN: Norderney Symposium on Scientific Results of the German Spacelab Mission D1, Norderney, Federal Republic of Germany, Aug. 27-29, 1986, Proceedings. Cologne, Federal Republic of Germany, Wissenschaftliche Projektfuehrung D1, 1987, p. 518-524. Research supported by the Max-Planck-Gesellschaft zur Foerderung der Wissenschaften and BMFT. refs

The absolute role of gravity in spatial coordinate assignment of human subjects is experimentally studied under conditions of microgravity on Spacelab mission D1. The relevance of gravity for the mental representation of space and the naming of spatial relations is investigated. The findings confirm that different reference frames are used under conditions of weightlessness and under 1 g conditions. On earth subjects use primarily the gravitationally defined vertical. Under microgravity, they use primarily the head axis, that is, the retina-defined vertical reference. C.D.

A88-28695* Texas Univ., Austin.

BEYOND FACE VALIDITY - A COMMENT ON NICHOLLS, LIGHT, AND PEARL

JANET T. SPENCE and ROBERT L. HELMREICH (Texas, University, Austin) Psychological Bulletin (ISSN 0033-2909), vol. 94, no. 1, 1983, p. 181-184. refs (Contract NAG2-137; NIH-MH-32066)

In their discussion of the Bem Sex Role Inventory (BSRI; Bem, 1974) and the Personal Attributes Questionnaire (PAQ; Spence and Helmreich, 1978), Nicholls, et al. (1982) blur two issues. The first concerns the legitimacy of equating the clusters of gender-related personality traits tapped by these instruments with the global constructs of masculinity and femininity. The second concerns item similarity between the PAQ and BSRI M scales and measures of self-esteem and the question of whether the several instruments measure the same or separable constructs. Decisions about each of these issues involve complex considerations that do not directly involve face validity. Author

N88-17188# City of Hope Medical Center, Duarte, Calif. Research Inst.

LONG TERM SYNAPTIC PLASTICITY AND LEARNING IN NEURONAL NETWORKS Annual Technical Report, 15 Aug. 1986 - 14 Aug. 1987

THOMAS H. BROWN 14 Sep. 1987 7 p

(Contract F49620-86-C-0099)

(AD-A186834; AFOSR-87-1477TR) Avail: NTIS HC A02/MF A01 CSCI 06A

The working hypothesis has been that longterm synaptic potentiation may mediate certain of the mnemonic functions of the hippocampal circuitry. The discovery of an underlying Hebbian conjunctive mechanism has boosted confidence in this hypothesis. One major effort of the past year was to summarize and integrate this AFOSR supported discovery into a more general theoretical and experimental framework. In regard to the 4 specific aims, development of the fluctuation algorithm has been completed, and it was applied to synaptic fluctuations obtained using the loose patch clamp method (aim 2). The algorithm is currently running on a mainframe at UCLA. It is now being implemented on a small workstation (Macintosh II). As soon as it is working on the Mac II, the quantal analysis in hippocampus will begin (aim 1). The culture method is underway (aim 3) and a first-generation video microscopic technique was developed for visualizing neurons and their synapses to see if the latter move during activity (aim 4). GRA

N88-17189# Human Engineering Labs., Aberdeen Proving Ground, Md.

BRAIN POTENTIALS AND PERSONALITY: A NEW LOOK AT STRESS SUSCEPTIBILITY Final Report

LINDA F. MULLINS and JEFFREY H. LUKAS Sep. 1987 21 p
(AD-A186931; HEL-TM-20-87) Avail: NTIS HC A03/MF A01
CSCS 06J

Today's soldier is confronted with physiological and psychological hardships that can affect the soldier's ability to function effectively and appropriately. This is seen as a breakdown of performance when sustained stress exceeds the soldier's capacity to cope. This experiment investigates an underlying constitutional factor, involving the central nervous system, that plays a role in how excitable an individual will be during any stressful or arousing situation. Subjects listened to 1,000-Hz tone bursts ranging 40 to 85 dB sensation level (SL) in 5-dB steps in a block-randomized fashion. The brain's electrical response to the tones was averaged and collected online. The peak amplitudes were measured and the slope of the line of best fit between evoked potential amplitude and intensity was computed. Auditory augmenters have positive slopes, that is, as intensity increases so does the evoked potential amplitude. Reducers show the opposite effect. The brain potentials become smaller or reduce as intensity increases, producing a negative slope. In addition, each subject completed Zuckerman's Sensation Seeking Scale (SSS) and Vando's Reducer-Augmenter (R-A) Scale. The slope measure was significantly correlated with the experience seeking subscale of the SSS. The results indicate that auditory augmenters prefer and seek out novel and exciting experiences. And in conjunction with previous humans and animal research, the results also suggest that the augmenters may cope better with stress and high workloads.

GRA

N88-17190# Dayton Univ., Ohio. Research Inst.
VISUAL ATTENTION EFFECTS ON DISCRIMINATION OF LINE ORIENTATION AND LINE ARRANGEMENT Final Technical Report, Feb. 1986 - Apr. 1987

MARYLOU CHEAL, DON LYON, and DAVID C. HUBBARD Nov. 1987 34 p
(Contract F33615-84-C-0066)
(AD-A187013; AFHRL-TR-87-22) Avail: NTIS HC A03/MF A01
CSCS 05H

The distinction between visual processes that require focused attention and those that use more diffuse or global attention is largely based on studies of visual search and texture segregation. It has been inferred from these studies that stimuli differing in the orientation of their component line segments can be distinguished without focal attention, whereas stimuli that differ only in the arrangement discrimination. In the first of the present experiments, while maintaining central fixation, attention was directed to a relevant peripheral target by a cue presented in the appropriate location. Discrimination of targets that differed in orientation of lines was minimally facilitated as the time between the onset of the valid cue and the onset of the target was increased from 17 msec to 268 msec. On the other hand, discrimination of targets composed of two conjoining line segments (sideways Ts) required time to shift and focus attention, and benefits increased with longer cue-target SOAs that allowed attention to accumulate at the target. To test whether orientation discrimination would be affected by focusing attention elsewhere in the visual field, a second experiment was conducted in which a cue misdirected attention on 20% of the trials. A decrement occurred on incorrectly cued trials in comparison to correctly cued trials for both types of stimuli, SLANTs and Ts.

GRA

N88-17191# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

IMAGE CHUNKING: DEFINING SPATIAL BUILDING BLOCKS FOR SCENE ANALYSIS

JAMES V. MAHONEY Apr. 1987 186 p
(Contract DACA76-85-C-0010; N00014-85-K-0124)
(AD-A187072; AI-TR-980) Avail: NTIS HC A09/MF A01
CSCS 05I

Rapid judgements about the properties and spatial relations of objects are the crux of visually guided interaction. Vision begins, however, with essentially pointwise representations of the scene, such as arrays of pixels or small edge fragments. For adequate time performance in recognition, manipulation, navigation, and reasoning, the processes that extract meaningful entities from the pointwise representations must exploit parallelism. A framework is developed for the fast extraction of scene entities, based on a simple, local model of parallel computation. An image chunk is a subset of an image that can act as a unit in the course of spatial analysis. A parallel preprocessing stage constructs a variety of simple chunks uniformly over the visual array. On the basis of these chunks, subsequent serial processes locate relevant scene components and assemble detailed descriptions of them rapidly. Image chunks are defined that facilitate the most potentially time-consuming operations of spatial analysis - boundary tracing, area coloring, and the selection of locations at which to apply detailed analysis. Fast parallel processes for computing these chunks from images, and chunk-based formulations of indexing, tracing and coloring, are presented. These processes have been simulated and evaluated on the LISP machine and the connection machine.

GRA

N88-17192# Human Engineering Labs., Aberdeen Proving Ground, Md.

MEASURING MENTAL WORKLOAD: A PERFORMANCE BATTERY Final Report

LESLIE A. WHITAKER, LYNN C. OATMAN, and MATTHEW D. SHANK Sep. 1987 32 p
(AD-A187118; HEL-TM-21-87) Avail: NTIS HC A03/MF A01
CSCS 05I

A performance test battery consisting of three tasks (memory/visual search, serial arithmetic, and column addition) was developed for use on an Apple 2 microcomputer. For each task, several workload parameters were varied via a menu. In three separate experiments, performance variables (response latency and error rate) were found to be sensitive to changes in workload. The test battery is an easy method of varying workload through the use of a controlled laboratory task. Future research measuring subjective opinions and evoked potentials is planned using this battery of tasks.

GRA

N88-17193# Massachusetts Inst. of Tech., Cambridge.
VISION ALGORITHMS AND PSYCHOPHYSICS Annual Technical Report, 1 Apr. 1986 - 31 Mar. 1987

WHITMAN RICHARDS 2 Oct. 1987 6 p
(Contract AF-AFOSR-0139-86)
(AD-A186773; AFOSR-87-1534TR) Avail: NTIS HC A02/MF A01
CSCS 12A

Over the past year, we have made significant progress in understanding shape perception based on curvature extrema. Through psychophysical experiments in conjunction with H.R. Wilson (Univ. of Chicago), we now are able to identify which of several computer algorithms for extracting curvature are biologically the most feasible.

GRA

N88-17194# Physics and Electronics Lab. TNO, The Hague (Netherlands). Operationele Research Div.

GAVID AND ACQUIR, TWO OPERATIONS-RESEARCH (OR) MODELS FOR VISUAL DETECTION

E. KOOL 20 Aug. 1985 50 p In DUTCH; ENGLISH summary
(Contract A84/KL/026)
(FEL-1985-72; ETN-87-90174) Avail: NTIS HC A03/MF A01

The principles of GAVID (Ground-to-Air Visual Detection) and ACQUIR, two OR models for visual detection, were studied. GAVID

is based on tests in which a relation between the detection probability and the apparent contrast of a given object is computed. ACQUIR is based on the preciseness of the observation of bar codes with a certain size. In the calculation of the apparent stimulation of the retina by a given object in the field of view of the observer, in both models the same formula was used for the reduction of the contrast by the atmosphere. In GAVID the simulation of searching an object within a given area was divided into separated fixations; in ACQUIR the determination of detection probabilities and times is based on the mean number of fixations necessary for searching the given area one time. Author (ESA)

N88-17195# European Space Agency, Paris (France).

REFINEMENT OF EYE-POINT-OF-REGARD MEASUREMENT WITH HELICOPTER PILOTS IN A FLIGHT EXPERIMENT

RAINER UCKERMANN, HANS RADKE, and KLAUS WENDIGGENSEN Oct. 1987 51 p Transl. into ENGLISH of Verbesserung der Blickzielerfassung bei Hubschrauberpiloten im Flugversuch (DFVLR, Brunswick, Fed. Republic of Germany), Nov. 1986 Original language document was announced as N87-29115

(ESA-TT-1073; DFVLR-FB-86-61; ETN-88-90942) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 53

The NAC-4 Eye Mark Recorder was tested in flight in order to make eye-point-of-regard measurements in helicopters simple and accurate. Twelve pilots served as subjects. It was tested whether a helmet mounting of the apparatus improves the wearing quality without deteriorating the accuracy of the measurements. The results show that the helmet-mounted apparatus can be worn much better, while the quality of the measurements is as good as with the original equipment. The new configuration is especially suitable for use in long duration experiments. ESA

N88-17196# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Abteilung Luft- und Raumfahrtpsychologie.

A VALIDITY STUDY OF A SELECTION PROCEDURE FOR STUDENT AIRLINE PILOTS

HANS-JUERGEN HOERMANN and PETER MASCHKE Aug. 1987 67 p In GERMAN; ENGLISH summary (DFVLR-FB-87-34; ISSN-0171-1342; ETN-88-91694) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, Federal Republic of Germany, DM 19.50

Predictive validities of an aptitude test battery for student airline pilots were determined, on the basis of the two criteria: training success (pass/fail) and pilot instructor's rating. Of 4207 applicants tested, 399 persons were accepted for training ab initio, 349 of them (88 percent) were successful. Multivariate data analyses resulted in acceptable validity coefficients. Whereas tests of psychomotor coordination and multiple task performance prove to be significant predictors for training success, such characteristics as mathematical reasoning, mental concentration, perceptual speed, and spatial orientation are more related to the instructor's ratings. A cost analysis demonstrates the high utility of the selection procedure. ESA

N88-17197# European Space Agency, Paris (France).

TEMPERAMENT STRUCTURE SCALES (TSS). TEST MANUAL

PETER MASCHKE Nov. 1987 68 p Transl. into ENGLISH of Temperament-Struktur-Skalen (TSS). Test Manual (DFVLR, Oberpfaffenhofen, Fed. Republic of Germany), 1986 Original language document was announced as N87-26504

(ESA-TT-1069; DFVLR-FB-86-58; ETN-88-91714) Avail: NTIS HC A04/MF A01; original German version available from DFVLR, Cologne, Fed. Republic of Germany DM 23.50

A 10 dimensional personality questionnaire for the selection of aviation personnel is described. The dimensions are: motivation, emotional stability, rigidity, extraversion, aggressiveness, vitality, dominance, personal warmth, spoiledness, and mobility. ESA

N88-17198# Argonne National Lab., Ill.

PROBABILISTIC NEURAL NETWORKS: IN OR OUT OF EQUILIBRIUM

J. W. CLARK 1987 11 p Presented at the 11th International Workshop on Condensed Matter Theories, Oulu, Finland, 27 Jul. 1987

(Contract W-31-109-ENG-38)

(DE88-002907; CONF-8707110-3) Avail: NTIS HC A03/MF A01

The long-term behavior of neural networks following exposure to external stimuli is central to attempts at modeling brain activity and to the design of physical systems imitating biological mechanisms of memory storage and recall. A given network may exhibit many attractors, while a given attractor may correspond to a fixed point, a terminal cycle, multiperiodic motion, or chaos. If the dynamical law by which the system updates its state is probabilistic rather than deterministic, one considers an ensemble rather than a particular system. The initial preparation of the system attendant to the imposition of a temporary stimulus is reflected in the specification of an initial probability distribution ($p_i(0)$) over microscopic system states i . Here an especially simple class of probabilistic neural network models is considered, simple in the senses that the large- t occupation probabilities are steady, implying a fixed-point attractor, and this final condition is unique, i.e. independent of initial preparation, for specified single-neuron properties and interneuronic couplings. DOE

N88-18146# Joint Publications Research Service, Arlington, Va. **DISCRETE ADAPTATION TO SENSORY CONFLICT**

B. I. POLYAKOV In *its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 130-137 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 82-86

Avail: NTIS HC A08/MF A01

According to current conceptions, impairment of the customary forms of interaction of afferent systems (sensory conflict) is the principal etiological factor of motion sickness (MS), including its space form. Individual differences in resistance to MS are attributable to the properties of adaptive systems, including the adenosympathetic system. The process of adaptation can be enhanced via several basically different pathways. These pathways are briefly discussed. B.G.

N88-18187# Katholieke Universiteit, Nijmegen (Netherlands). Psychologisch Lab.

UNIDIMENSIONAL RASCH MODEL AND MULTIDIMENSIONAL DATA: AN ANALYTIC APPROACH

A. L. VANDENWOLLENBERG and J. M. WIT 15 Dec. 1986

30 p

(PB88-105861; REPT-86-MA-01) Avail: NTIS HC A03/MF A01 CSCI 051

An analytic approach is given of the influence of multidimensionality on unidimensional measurement in the context of the Rasch model. For a linear compensatory multidimensional data structure, the Pearson correlation is derived between the dominant latent trait, shared by all items, and the latent trait which results from the linear compensatory model. The correlation depends on the number of traits, the level of predominance of the dominant trait, the correlation among the traits and finally of the trait variances. Under some conditions the correlation between the dominant latent trait and the composite latent trait is .97 or higher. By means of Monte Carlo simulation studies it is demonstrated that the derived correlation is a good quantitative description of the influence of multidimensionality upon Rasch ability estimates. The correlation between the dominant latent trait and the estimated trait can be decomposed into two multiplicative components; the correlation between the dominant trait and the composite trait on the one hand and the correlation between the composite trait and the estimated trait on the other hand. The last correlation is looked upon as the index of reliability of the estimation. Author

N88-18188# Ohio State Univ., Columbus. Research Foundation.

PERCEPTION AND CONTROL OF SIMULATED SELF MOTION Final Report, Apr. 1983 - Mar. 1987

DEAN H. OWEN, SCOTT J. FREEMAN, BRIAN F. ZAFF, and LAWRENCE WOLPERT Nov. 1987 194 p

(Contract F33615-83-K-0038)

(AD-A187444; AFHRL-TR-87-16) Avail: NTIS HC A09/MF A01 CSCI 06D

This report includes three experiment sections. The first experiment tested sensitivity decreased with higher flow rates, and demonstrated that: (1) preview effects led to adaptation, (2) sensitivity decreased with higher flow rates, and (3) sensitivity increased with higher optical texture densities and fractional loss. The second and third experiments examined the perception and control of change in forward speed and altitude, respectively. Results from the former indicated that higher levels of fractional loss led to enhanced control of a consistent speed, whereas high flow and/or edge rates interfered with performance. The control of altitude change was similarly affected by the levels of fractional loss, but the negative effect of flow rate occurred only in conditions of descending flight. Theoretical implications for the ecological approach to the study of perception and control are discussed.

GRA

N88-18189# Naval Personnel Research and Development Center, San Diego, Calif.

METHODS OF ELICITING INFORMATION FROM EXPERTS

DAVID MEISTER Oct. 1987 27 p

(AD-A187468; NPRDC-TN-88-2) Avail: NTIS HC A03/MF A01 CSCI 05H

The biggest bottleneck in the development of expert systems is the problem of eliciting from experts the mechanisms responsible for their expertise. This report examines what is known about experts and suggests a number of ways of eliciting information from them. The literature suggests that the mechanisms of expertise represent deep-seated ways of conceptualizing and perceiving stimuli, and that these mechanisms must be differentiated from relatively superficial proceduralized rules, which make up most of what expert information consists of today. The goal of reproducing the expert's mental processes in a computer system appears unrealistic at present. The only way of determining that one has, in fact, tapped expertise is to build the expert system and evaluate its effectiveness. If it matches or surpasses human proficiency, one has incorporated human expertise into the system. GRA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A88-25083

HUMAN-COMPUTER MONITORING

RAJA PARASURAMAN (Catholic University of America, Washington, DC) Human Factors (ISSN 0018-7208), vol. 29, Dec. 1987, p. 695-706. refs

The present consideration of human-computer attentional factors encompasses vigilance effects in complex monitoring tasks, factors that influence an optimal combination of human and computer monitors, and the effects of increased automation on the mental workload-vigilance relationship. Vigilance effects can limit performance in complex monitoring tasks due to either vigilance decrements over time or sustained low levels of vigilance; computer assistance to enhance performance is feasible, but may not be effective in all cases. Performance gain depends on the decision rule for combining human and computer decisions, as well as the mental workload imposed on the human monitor.

Implications for automated monitoring system design are discussed. O.C.

A88-25085* Miami Univ., Coral Gables, Fla.

APPLICATION OF VIGILANCE RESEARCH - RARE, MEDIUM, OR WELL DONE?

EARL L. WIENER (Miami, University, Coral Gables, FL) Human Factors (ISSN 0018-7208), vol. 29, Dec. 1987, p. 725-736. refs (Contract NCC2-377)

In the years since Mackworth (1950) initiated research into problems of human vigilance, automated systems have become more complex and costly, with greater repercussions upon failure; this has led to a paradoxical enhancement of human monitoring's importance. Applications of vigilance research to well-designed systems that take human monitoring into account are rare, although the outlook for future systems is improving. Attention is presently given to problems encountered in considerations of signal rate, length of vigil, time decrements, and two examples of implementation from commercial aviation. O.C.

A88-26717

CHROMATIC AFTEREFFECTS ASSOCIATED WITH A NIGHT VISION GOGGLE SIMULATION

KIRK MOFFITT, STEVEN P. ROGERS, and JOSEPH CICINELLI (Anacapa Sciences, Inc., Santa Barbara, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Feb. 1988, p. 125-128.

(Contract DAAB07-85-C-F036)

A visual perception experiment was conducted to determine the chromatic aftereffects of viewing a yellow-green field that simulated the display of current night vision goggles. Six females and two males served as subjects in a color-naming procedure. Subjects sequentially viewed an adaptation field, which was either yellow-green or white, and small colored targets presented on a CRT display. The time required to name the color of the targets was found to be dependent on the color of the adaptation field, the color of the target, and the interaction of these two variables. It was recommended that the effects of attenuation of the luminance of the night vision goggles be studied, and that color cockpit displays be redundantly coded whenever possible.

Author

A88-26725

ANTI-G STRAINING MANEUVER INCOMPATIBILITY WITH TACTICAL AIRCRAFT OXYGEN SYSTEMS

J. T. WHITE (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, FL) and L. M. E. MORIN (U.S. Navy, Naval Aerospace Medical Institute, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Feb. 1988, p. 176, 177. refs

A spectrum of clinical symptoms consisting of grey-out, black-out, and G-induced loss of consciousness has been identified in pilots of high-performance aircraft. The M-1 maneuver used in conjunction with reclined seats and inflated G-suit provides significant protection against these symptoms. Centrifuge-trained U.S. Navy tactical aircraft pilots have recently reported a decreased ability to perform the M-1 maneuver while using the MBU-12P oxygen mask and CRU-79/P oxygen regulator. This report reviewed the performance specifications of these devices and compared them with published pulmonary flow rates. This oxygen system is found to interfere with the performance of the M-1 and other anti-G maneuvers. Further research is needed to characterize pulmonary flow rates during the performance of the M-1 maneuver in order to make recommendations for breathing-system standards aboard high-performance aircraft. Author

A88-26975#

DEVELOPMENT OF A MASTER SLAVE MANIPULATOR SYSTEM FOR SPACE USE

YOSHITSUGU TODA, KAZUO MACHIDA, TOSHIKI IWATA, and MASAKUNI KAWADA Japan Society for Aeronautical and Space Sciences, Journal (ISSN 0021-4663), vol. 35, no. 406, 1987, p. 546-553. In Japanese, with abstract in English. refs

A generalized master slave manipulator system which was assumed to operate near/or around the Space Station was developed. A standardized serial communication line was used between the master and the slave manipulator. The master manipulator was designed to be self-balanced to simulate operation under the zero-gravity condition. A force/torque reflecting bilateral control using the force-torque sensor settled at the wrist of the slave manipulator was adopted. An experiment in which the slave manipulator was in a vacuum chamber was performed, within restricted sight of cameras set up in the chamber. The problems which would result from adopting a generalized master slave manipulator system were almost solved, except for the delay caused by the calculation time. Author

A88-27149

FLOW STRUCTURES IN PROBLEMS OF ENGINEERING-PHYSIOLOGICAL SYSTEM MODELING [POTOKOVYE KONSTRUKTSII V ZADACHAKH MODELIROVANIYA INZHENERNO-FIZIOLOGICHESKIKH SISTEM]

Z. A. KUCHKAROV IN: Methods for the optimization of complex systems. Moscow, Izdatel'stvo Nauka, 1987, p. 118-121. In Russian. refs

The concept of flow in engineering-physiological systems, defined as complex multiply connected systems of heterogeneous flows of matter, energy, and information, is examined, and ten known theoretical flow schemes are discussed. These include the Ford-Falkerson structure, the pharmacokinetic structure, the Forrester structure, and a group of structures comprising fluid flow structures, heat flow structures, and electrodynamic flow structures. A mathematical formalism based on the polyschematic approach is proposed. V.L.

A88-27634#

QUALITATIVE REQUIREMENTS OF A MODERN FIGHTER AIRCRAFT

B. D. JAYAL Aviation Medicine, vol. 30, June 1986, p. 9-12.

The requirements of a combat aircraft are examined together with the operational principles and the utility of devices that help to achieve an effective pilot-vehicle interface, such as electronic cockpits, head-up displays, multifunction displays, hands-on throttle and stick layout, voice command systems, helmet-mounted sights, and touch panels. It is pointed out that, to cope with the multirole aircraft requirements where a very high volume of information will be processed and displayed, a two-pilot concept may become necessary to maintain physical and mental alertness of the crew. The need for the protection of the crew in a nuclear biological and chemical environment by supplying a special airconditioning system, clothing, mask, and oxygen system is emphasized. I.S.

A88-27635#

HUMAN ENGINEERING ASPECTS - WORK SPACE LAYOUT

R. R. KAPUR Aviation Medicine, vol. 30, June 1986, p. 13-16.

This paper discusses the design requirements of the working space in modern combat aircraft, which would be highly compatible with the need of the pilot to maintain visual acuity, use of limbs, and mental activity at high accelerations. Consideration is given to geometrical factors of cockpit design, such as the hill rest-line, seat back angle, over-the-nose vision, and the position of the stick. Special attention is given to the anthropometric considerations in the design of controls, displays, and escape routes; visual requirements for both the outside and inside the cockpit; reach envelope considerations; and displays and controls concepts. I.S.

A88-27636#

CABIN ENVIRONMENTAL CONTROL IN COMBAT AIRCRAFT

RANJIT KUMAR Aviation Medicine, vol. 30, June 1986, p. 17-19.

The requirements of the cabin environmental control of a combat aircraft are discussed together with medical problems related to the changes in cabin environment. Particular consideration is given to problems related to reduction in barometric pressure, such as hypoxia occurring due to the reduction in partial O₂ pressure, and decompression sickness caused by rapid decompression following loss of the canopy as a result of enemy action or deliberate jettisoning. Attention is also given to problems related to changes of thermal environment and to noise and vibration. It is pointed out that, due to the high cost of weight/power penalties for an ideal cabin, compromises may be necessary at the cost of some discomfort and an acceptable physiological strain on the aircraft occupants. I.S.

A88-27637#

ACCELERATION STRESS - DESIGN CONSIDERATIONS

J. K. GUPTA Aviation Medicine, vol. 30, June 1986, p. 20-23.

The equipment and methods designed to safeguard the operator of a combat aircraft against the possibility of the G-induced loss of consciousness are discussed. Attention is given to the design considerations of the high-G cockpit, considering the ameliorating effects of the reclined back seat, movable head rest, and a head rest sight and display system, in which the CRT and the projection optics are carried in the head rest mechanism, instead of in the helmet, thus reducing the helmet weight. It is emphasized that the ameliorating effect of an anti-G cockpit can be reinforced by programs of pilot training designed to build up the muscles of upper torso, neck and arm, and to increase the pilot's threshold of G tolerance. I.S.

A88-27638#

PERFORMANCE ON HAND AND FOOT OPERATED CONTROLS UNDER LOW FREQUENCY VIBRATION

M. K. VYAWAHARE Aviation Medicine, vol. 30, June 1986, p. 24-32. refs

The effects of vibration on the pilot's performance on the push-pull types of hand-operated controls was investigated using an electrohydraulic vibrator to generate vibrations of various intensities and frequencies. Vibration transmission was determined for subjects sitting erect on four different types of seats: an uncushioned seat, a compressible cushion, a glass fiber cushion, or a glass fiber cushion combined with a glass fiber back rest. The mean values of vibration transmission at the shoulder and the thigh levels were found to be maximal between 5 to 6 Hz. The shoulder level maximum transmission was the highest for the case of uncushioned seat, whereas the seat type did not affect the thigh level maximum transmission. Performance on push-pull types of hand operations and on rudder pedal for foot operations was found to be affected most in the frequency range of 3 to 7 Hz, with the frequency of maximum vibration transmission not necessarily corresponding to the maximum effect on push-pull performance. I.S.

A88-28027

AUTOMATED INSTRUMENT FOR QUANTITATIVE STUDIES OF KINETICS OF AGGREGATION OF RED BLOOD CELLS UNDER ZERO GRAVITY

LEOPOLD DINTENFASS (Sydney Hospital, Australia), PETER D. OSMAN (CSIRO, Div. of Applied Physics, Sydney, Australia), and A. G. WILLARD (New South Wales, University, Kensington, Australia) Institution of Engineers, Multi-Disciplinary Engineering Transactions (ISSN 0812-3314), vol. GE9, 1985, p. 20-25. Research supported by the Philip Bushell Foundation, Department of Science and Technology, CSIRO, et al. refs

This paper describes an automated instrument developed for quantitative studies of red blood cell aggregation kinetics at zero gravity. The central unit of this instrument is a slit-capillary photoviscometer equipped with two microphotography cameras; the instrument also includes blood and saline sample selection

and infusion mechanisms, an automated control and data acquisition system, and solid state memory. The instrument, loaded with blood samples, saline, refrigerant, and photographic film, will be installed on the middeck of the Space Shuttle, and connected with the Shuttle power source. The slides obtained during the spaceborne experiment will be evaluated by TV scan on the Microvideomat 3, using methodology developed earlier by Dintenfass and his collaborators. Schemes of the instrument and optical subsystem are included together with results obtained on ground on the aggregates of red cells in blood from different donors. I.S.

N88-16644*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HELICOPTER HUMAN FACTORS RESEARCH

DAVID C. NAGEL and SANDRA G. HART /in NASA, Washington, NASA/Army Rotorcraft Technology. Volume 2: Materials and Structures, Propulsion and Drive Systems, Flight Dynamics and Control, and Acoustics p 929-947 Feb. 1988
Avail: NTIS HC A25/MF A01 CSCL 05H

Helicopter flight is among the most demanding of all human-machine integrations. The inherent manual control complexities of rotorcraft are made even more challenging by the small margin for error created in certain operations, such as nap-of-the-Earth (NOE) flight, by the proximity of the terrain. Accident data recount numerous examples of unintended conflict between helicopters and terrain and attest to the perceptual and control difficulties associated with low altitude flight tasks. Ames Research Center, in cooperation with the U.S. Army Aeroflightdynamics Directorate, has initiated an ambitious research program aimed at increasing safety margins for both civilian and military rotorcraft operations. The program is broad, fundamental, and focused on the development of scientific understandings and technological countermeasures. Research being conducted in several areas is reviewed: workload assessment, prediction, and measure validation; development of advanced displays and effective pilot/automation interfaces; identification of visual cues necessary for low-level, low-visibility flight and modeling of visual flight-path control; and pilot training. Author

N88-16653*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN INTEGRATED APPROACH TO ROTORCRAFT HUMAN FACTORS RESEARCH

SANDRA G. HART, E. JAMES HARTZELL, JAMES W. VOORHEES, NANCY M. BUCHER, and R. JAY SHIVELY (Army Aviation Systems Command, Moffett Field, Calif.) /in NASA, Washington, NASA/Army Rotorcraft Technology. Volume 3: Systems Integration, Research Aircraft, and Industry p 1167-1188 Feb. 1988
Avail: NTIS HC A17/MF A01 CSCL 05H

As the potential of civil and military helicopters has increased, more complex and demanding missions in increasingly hostile environments have been required. Users, designers, and manufacturers have an urgent need for information about human behavior and function to create systems that take advantage of human capabilities, without overloading them. Because there is a large gap between what is known about human behavior and the information needed to predict pilot workload and performance in the complex missions projected for pilots of advanced helicopters, Army and NASA scientists are actively engaged in Human Factors Research at Ames. The research ranges from laboratory experiments to computational modeling, simulation evaluation, and inflight testing. Information obtained in highly controlled but simpler environments generates predictions which can be tested in more realistic situations. These results are used, in turn, to refine theoretical models, provide the focus for subsequent research, and ensure operational relevance, while maintaining predictive advantages. The advantages and disadvantages of each type of research are described along with examples of experimental results. Author

N88-17199# Air Force Academy, Colo.

DYNAMIC FUNCTION ALLOCATION IN FIGHTER COCKPITS Final Report, Oct. 1986 - May 1987

JOSEPH HICKOX and SUSAN KEGLER 30 Jun. 1987 27 p
(AD-A185397; FJSRL-TR-87-0004) Avail: NTIS HC A03/MF A01 CSCL 01C

The objective of this study was to investigate alternatives for allocating the tasks associated with defensive counter measures in a fighter cockpit environment. The three methods allocated the functions either totally to the operator or a simulated expert system and dynamically at the operator's request to either. The analysis of the objective data showed there were no significant performance differences among the three treatment conditions. However, the analysis of post treatment subjective data showed the subjects did have confidence in the simulated expert system's ability to handle the threats (p less than .01) and they had a significant preference for some form of computer assistance during the missions (p less than .01). Author (GRA)

N88-17200# Air Force Human Resources Lab., Brooks AFB, Tex. Technical Services Div.

AIR FORCE HUMAN RESOURCES LABORATORY TECHNICAL REPORTS AND TECHNICAL PAPERS Quarterly R and D Summary, Jul. - Sep. 1987

ESTHER M. BARLOW, ed. Oct. 1987 10 p
(AD-A186830) Avail: NTIS HC A02/MF A01 CSCL 05B

This document contains a summary of each Air Force Human Resources Laboratory Technical Report and Technical Paper that the Humans System Division Public Affairs Office has approved for public release during the past 3 months. It outlines an empirical system for assessing the impact of aptitude requirement adjustments on Air Force initial skills training; appropriateness measurement; walk-through performance testing: An innovative approach to work sample testing; job performance measurement in the military: A classification scheme, literature review, and directions for research; integrated maintenance information system: Training technology scenarios; air traffic controller trainee selection; basic attributes test (BAT) system: A preliminary evaluation; aircrew training devices: Utility and utilization of advanced instructional features; visual attention effects on discrimination of line orientation and line arrangement; training decisions system: Overview, design, and data requirements; visual contrast sensitivity functions: A comparison of two psychophysical procedures using untrained observers; how quickly can attention affect form perception, and manpower, personnel, training, and safety guidance and control for weapon system acquisitions. GRA

N88-17201# Human Engineering Labs., Aberdeen Proving Ground, Md.

COMPARISON OF ALPHANUMERIC DATA ENTRY METHODS FOR ADVANCED HELICOPTER COCKPITS Final Report

FRANK J. MALKIN and KATHLEEN A. CHRIST Sep. 1987

51 p
(AD-A186934; HEL-TM-17-87) Avail: NTIS HC A04/MF A01 CSCL 01C

In this study, three methods of data entry were compared for entering navigation coordinate sets: (1) connected-word voice recognition, (2) keyboard, and (3) thumb-controlled switch. The subjects, 12 active Army aviators, entered the data as a sole task and also while flying a helicopter simulator equipped with a computer-generated, external scene. The different data entry methods were compared for time to enter the data, for errors, and for the effect on flight performance. Results showed that the keyboard was faster and resulted in fewer errors than the other two data entry methods. The time to enter data by voice was increased by the high nonrecognition rate (12 percent) and the error correction procedure. An overall 81 percent recognition accuracy rate was achieved in this study, with individual rates varying from 58 percent to 99 percent. Based on a subjective questionnaire, the majority of subjects still preferred to enter data by voice. GRA

N88-17202# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Afdeling Technische Menskunde.
SITTING POSTURE OF PILOTS IN THE BOELKOW 105C HELICOPTER

D. S. C. OSINGA and H. SCHUFFEL Sep. 1986 41 p In DUTCH; ENGLISH summary
 (Contract A82/KLU/113)
 (IZF-1986-22; TD-86-3472; ETN-88-91306) Avail: NTIS HC A03/MF A01

Following pilots' complaints of backpain in the Boelkow 105c, sitting posture was analyzed. Position and range of controls, seat fixations, demands for outside view and view obstructions, and available cockpit space were tested against data of the static and functional anthropometry, resulting in a specification of the desired sitting posture. For the design of the cockpit geometry the existing criteria do not appear to meet the requirement. They are based on a maximum stature of 187 cm and permit a maximum stretch of shoulder and arm muscles. A comparison of the desirable sitting posture and the actual sitting posture in the 105c shows large differences. Differences cannot be compensated by modifications of the chair only. It is recommended to use the desired sitting posture as the reference in case of the specification of aircrew station geometry in helicopters, and to use mock-ups as a design tool. ESA

N88-17203# Queensland Univ., Brisbane (Australia). Dept. of Primary Industries.

FOOD IRRADIATION SEMINAR: ASIA AND THE PACIFIC

G. E. MITCHELL 1986 27 p
 (DE88-700432; INIS-MF-11038) Avail: NTIS (US Sales Only) HC A03/MF A01

The report covers the Seminar for Asia and the Pacific on the practical application of food irradiation. The seminar assessed the practical application of food irradiation processes, commercial utilization and international trade of irradiated food. DOE

N88-17204# Cranfield Inst. of Tech., Bedford (England). Work Organisation and Ergonomics Lab.

ERGONOMICS OF CAR CONTROLS FOR DISABLED PEOPLE, PHASE 1. PART 1: CHAPTERS 1-7. PART 2: APPENDICES. PART 3: REFERENCES

PAUL KEMBER and PETER STADDON Mar. 1987 314 p
 (Contract PROJ. TRR/842/540)
 (ISBN-0-947767-82-7) Avail: NTIS HC A14/MF A01

The primary objective is to determine the values or ranges of values of forces that disabled people can exert on the primary controls of an automobile. This will lead to recommendations on desirable range of force and movement to best facilitate use by the disabled. A second objective is to determine the force and movements required to operate the primary controls on the present models of those cars likely to be purchased by disabled persons, using both data collected from car manufacturers and also data obtained from testing cars converted for use by disabled people. Apart from defining maximum force for the use of normal controls it is also intended to define acceptable limits for high-gain, low force controls. The program is structured in three phases: literature and data base searches, compilation of information from assessment centers; measurement of physical abilities of drivers including laboratory experiments; and measurement of vehicle and control system characteristic, methods of objectively defining high and low force limits, identification of gaps in knowledge. Author

N88-17241*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

A SITUATION-RESPONSE MODEL FOR INTELLIGENT PILOT AIDING

ROBERT SCHUDY and KEVIN CORKER /n NASA. Lyndon B. Johnson Space Center, Houston, Texas, First Annual Workshop on Space Operations Automation and Robotics (SOAR 87) p 253-259 Oct. 1987
 Avail: NTIS HC A23/MF A01 CSCL 05H

An intelligent pilot aiding system needs models of the pilot information processing to provide the computational basis for

successful cooperation between the pilot and the aiding system. By combining artificial intelligence concepts with the human information processing model of Rasmussen, an abstraction hierarchy of states of knowledge, processing functions, and shortcuts are developed, which is useful for characterizing the information processing both of the pilot and of the aiding system. This approach is used in the conceptual design of a real time intelligent aiding system for flight crews of transport aircraft. One promising result was the tentative identification of a particular class of information processing shortcuts, from situation characterizations to appropriate responses, as the most important reliable pathway for dealing with complex time critical situations. Author

N88-17242*# McDonnell Aircraft Co., St. Louis, Mo. Design Engineering-Human Factors.

A HUMAN PERFORMANCE MODELLING APPROACH TO INTELLIGENT DECISION SUPPORT SYSTEMS

MICHAEL S. MCCOY and RANDY M. BOYS (Texas Instruments, Inc., Dallas.) /n NASA. Lyndon B. Johnson Space Center, Houston, Texas, First Annual Workshop on Space Operations Automation and Robotics (SOAR 87) p 261-268 Oct. 1987
 Avail: NTIS HC A23/MF A01 CSCL 05H

Manned space operations require that the many automated subsystems of a space platform be controllable by a limited number of personnel. To minimize the interaction required of these operators, artificial intelligence techniques may be applied to embed a human performance model within the automated, or semi-automated, systems, thereby allowing the derivation of operator intent. A similar application has previously been proposed in the domain of fighter piloting, where the demand for pilot intent derivation is primarily a function of limited time and high workload rather than limited operators. The derivation and propagation of pilot intent is presented as it might be applied to some programs. Author

N88-17273*# Rockwell International Corp., Downey, Calif. Space Station Systems Div.

CREW INTERFACE WITH A TELEROBOTIC CONTROL STATION

EVA MOK /n NASA. Lyndon B. Johnson Space Center, Houston, Texas, First Annual Workshop on Space Operations Automation and Robotics (SOAR 87) p 493-496 Oct. 1987
 Avail: NTIS HC A23/MF A01 CSCL 05H

A method for apportioning crew-telerobot tasks has been derived to facilitate the design of a crew-friendly telerobot control station. To identify the most appropriate state-of-the-art hardware for the control station, task apportionment must first be conducted to identify if an astronaut or a telerobot is best to execute the task and which displays and controls are required for monitoring and performance. Basic steps that comprise the task analysis process are: (1) identify space station tasks; (2) define tasks; (3) define task performance criteria and perform task apportionment; (4) verify task apportionment; (5) generate control station requirements; (6) develop design concepts to meet requirements; and (7) test and verify design concepts. Author

N88-17280*# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Air Crew Escape Group.

HYPERVELOCITY TECHNOLOGY (HVT) CREW ESCAPE

LANNY A. JINES /n NASA. Lyndon B. Johnson Space Center, Houston, Texas, First Annual Workshop on Space Operations Automation and Robotics (SOAR 87) p 541-547 Oct. 1987
 Avail: NTIS HC A23/MF A01 CSCL 05H

Conceptual designs are being investigated for escape systems applicable to hypervelocity technology class aerospace vehicles. The concepts selected for further development will provide survivable escape and recovery throughout all phases of flight. Sixteen conceptual escape systems were identified, of which two were viable. The study vehicles included a horizontally launched vehicle (HLV) and a vertically launched vehicle (VLV). Computer-aided design models of the candidate escape systems were developed. State-of-the-art or near-term enabling technologies

were identified in such areas as propulsion, life support, thermal protection, and deceleration. Author

N88-17281* Essex Corp., Orlando, Fla.

SURROGATE MEASURES: A PROPOSED ALTERNATIVE IN HUMAN FACTORS ASSESSMENT OF OPERATIONAL MEASURES OF PERFORMANCE

ROBERT S. KENNEDY, NORMAN E. LANE, and LOIS A. KUNTZ
In NASA. Lyndon B. Johnson Space Center, Houston, Texas, First Annual Workshop on Space Operations Automation and Robotics (SOAR 87) p 551-558 Oct. 1987

Avail: NTIS HC A23/MF A01 CSDL 05H

Surrogate measures are proposed as an alternative to direct assessment of operational performance for purposes of screening agents who may have to work under unusual stresses or in exotic environments. Such measures are particularly proposed when the surrogate can be empirically validated against the operational criterion. The focus is on cognitive (or throughput) performances in humans as opposed to sensory (input) or motor (output) measures, but the methods should be applicable for development of batteries which will tap input/output functions. A menu of performance tasks is under development for implementation on a battery-operated portable microcomputer, with 21 tests currently available. The tasks are reliable and become stable in minimum amounts of time; appear sensitive to some agents; comprise constructs related to actual job tasks; and are easily administered in most environments. Implications for human factors engineering studies in environmental stress are discussed. Author

N88-17851# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany). Unternehmensgruppe Transport- und Verkehrsflugzeuge.

TRENDS IN THE DISTRIBUTION OF TASKS BETWEEN COMMERCIAL PILOTS AND FLIGHT CONTROL SYSTEMS [ZUR AUFGABENTEILUNG ZWISCHEN VERKEHRSPILOTEN UND FLUGFUEHRUNGSSYSTEMEN - TRENDS]

HARTWIG SEELER In *its* Research and Development. Technical-Scientific Publications (1956-1987): Retrospective View and Prospects. Jubilee Edition on the Occasion of the 75th Anniversary of Dipl.-Engr. Dr.-Engr. E.H. Ludwig Boelkow p 203-208 1987 In GERMAN

(MBB-UT-008/87) Avail: NTIS HC A14/MF A01

Trends to relieve pilots by a reorganization of the pilot and cockpit tasks are discussed. Simplification of the navigation tasks; radio telephony; interlocking of unacceptable pilot functions or flight paths; operational simplifications; and information are treated.

ESA

N88-18135# Joint Publications Research Service, Arlington, Va. **ANALYSIS OF WATER RECOVERED AFTER BEING USED FOR WASHING BY MEN AND WOMEN**

A. A. BERLIN and S. L. CHEKANOVA In *its* JPRS Report: Science and Technology. USSR: Space Biology and Aerospace Medicine, v. 21, no. 5, Sep. - Oct. 1987 p 78-83 25 Feb. 1988 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 21, no. 5, Sep. - Oct. 1987 p 53-57

Avail: NTIS HC A08/MF A01

The composition of wash water used by men and women was investigated. The results were exposed to multifactorial statistical analysis using the method of principal components. The investigations allowed the following conclusions to be made: (1) wash water used by men and women is comparable in composition; therefore, the sex of the crewmembers of space vehicles can be disregarded when designing water reclamation systems; (2) three parameters, viz. oxidability, electric conductivity, and chloride content, can be adequately used to assess the quality of utilized wash water; and (3) the composition of wash water is largely dependent on the health status of its users. Author

N88-18190# Rockwell International Corp., Canoga Park, Calif. **INTERNATIONAL COOPERATIVE EFFORT TO ESTABLISH ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS) STANDARDS FOR THE MEASUREMENT OF RADIATION DOSE FOR FOOD PROCESSING**

H. FARRAR, IV 1987 4 p Presented at the 3rd Engineering Foundation Conference on Advancing Food Technology with the Irradiation Process, Santa Barbara, Calif., 15 Nov. 1987

(Contract DE-AC03-83SF-11903)

(DE88-002702; CONF-8711103-1) Avail: NTIS HC A02/MF A01

A task group has been formed within the American Society for Testing and Materials (ASTM) specifically to develop standards for measuring radiation dose for food processing. The task group, which has 78 members, including 16 from Europe, consists of a broad cross section of food industry, government, regulatory, manufacturing, and university interests. The group is working on seven standards; three specifically for food irradiation applications, and four for using specific dosimeter types for all radiation applications, including food processing. Together, this set of standards will specify acceptable methods of accomplishing the required irradiation treatment of food and other products, and will be available for adoption by regulatory agencies in food irradiation protocols. DOE

55

SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A88-26071

CATALYSTS OF THE MELANIN-MELANOIDIN TYPE IN THE ABIOGENESIS OF PEPTIDES [KATALIZATORY MELANINO-MELANOIDINOVOGO TIPA V ABIOGENEZE PEPTIDOV]

T. A. TELEGINA and T. E. PAVLOVSKAIA (AN SSSR, Institut Biokhimii, Moscow, USSR) Akademii Nauk SSSR, Izvestiia, Seria Biologicheskaiia (ISSN 0002-3329), Jan.-Feb. 1988, p. 112-117. In Russian. refs

This paper considers pathways in the abiogenic synthesis of proteinlike substances during prebiotic evolution along with the role of inorganic and organic catalysts in the abiogenesis, with particular attention given to the melanin and melanoidin polymers, which could be formed in the acetaldehyde-ammonium salt systems. These polymers display photoprotective and catalytic properties, which appear to be associated with the presence of nitrogen-containing rings and conjugated double bonds. Such structures enable melanoid-type molecules to strongly absorb UV light. Thus these compounds could have made solar energy available for the first photosynthetic reactions. I.S.

N88-17205* National Aeronautics and Space Administration, Washington, D.C.

PUBLICATIONS OF THE EXOBIOLOGY PROGRAM FOR 1986: A SPECIAL BIBLIOGRAPHY

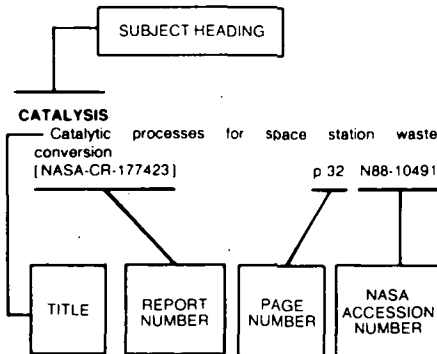
Mar. 1988 57 p Prepared in cooperation with George Washington Univ., Washington, D.C.

(Contract NASW-3165)

(NASA-TM-4029; NAS 1.15:4029) Avail: NTIS HC A04/MF A01 CSDL 06B

A list of 1986 publications resulting from research pursued under the auspices of NASA's Exobiology Program is contained. Research supported by the program is explored in the areas of cosmic evolution of biogenic compounds, prebiotic evolution, early evolution of life, and evolution of advanced life. Prepermission and preproject activities supporting these areas are supported in the areas of solar system exploration and search for extraterrestrial intelligence. Author

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

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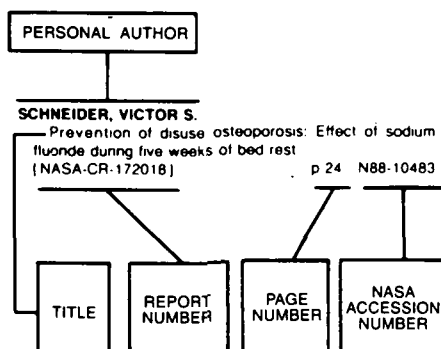
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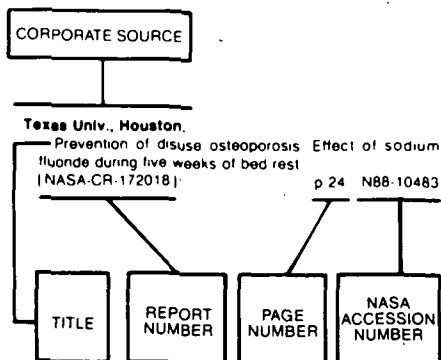
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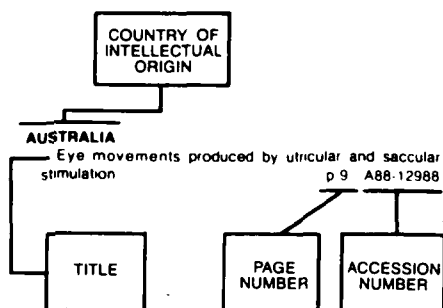
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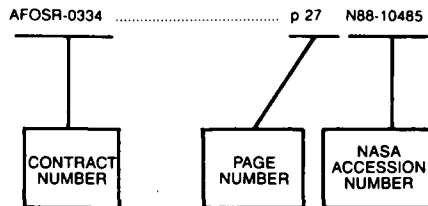
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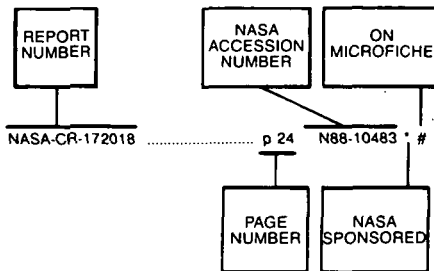
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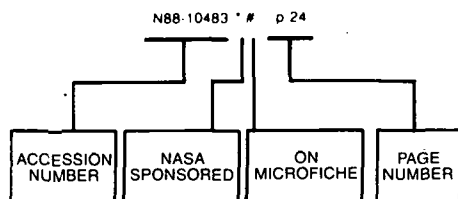
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